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### DIESEL RAILWAY TRACTION

*A Supplement illustrating and describing developments in Diesel Railway Traction is presented with each copy of this week's issue.*

#### Daniel Nicol Dunlop

THE British Electrical and Allied Manufacturers' Association and the World Power Conference have each lost their founder in the death of Mr. D. N. Dunlop, O.B.E., on May 30. For many years past he has been one of the most prominent figures in the British electrical industry and took an active part in the foundation of the Electrical Research and Electrical Development Associations and was recently elected independent Chairman of the Electrical Fair Trading Council. Realising the weakness of British electrical industry in competition with Germany and other countries, Mr. Dunlop saw that only combination of interests could save it. Accordingly he resigned from the British Westinghouse in 1911, to found the British Electrical & Allied Manufacturers' Association (B.E.A.M.A.), the phenomenal success of which is in itself a remarkable tribute to his foresight and powers of organisation. In wider circles too, Mr. Dunlop will be remembered as the founder of the World Power Conference. He enlisted the support of the council of the B.E.A.M.A. to ensure adequate financial backing for the institution of the First World Power Conference, which was opened by the Prince of Wales in June, 1924, in the presence of representatives of about 40 countries. The success of the conference is attributed largely to Mr. Dunlop's tact and patience as Chairman of its International Executive Council.

#### Rail and Air Co-ordination

When the first railway-operated air service was inaugurated in this country by the G.W.R. in 1933, it was for the purpose of providing faster transport over a route somewhat roundabout by railway, rather than with a view to furnishing co-ordinated services by rail and air. The innovation of the aeroplane as an auxiliary service was the result of foresight as to the manner in which the railways could secure what financial benefit might be derived in the future from a mode of transport likely to grow rapidly in popularity. Now, however, there is a new move to relate even more closely the railway with the aeroplane. Whereas in the past the approach to the aerodrome has in most cases been by road, it is now proposed to make the railway the principal link between the populated areas and the airport. There are of course at present some instances where the railway serves the aerodrome direct, a notable example being at Squire's Gate, Blackpool, where the aerodrome lies adjacent to the L.M.S.R. station of that name. A new company registered as Airports Limited, however, details of which are given on page 1176, makes the air-rail co-ordination its prime object in the development of an airport at Gatwick, which will be served by its own special station now being built by the Southern Railway on the electrified Brighton line.

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#### The Week's Traffics

Traffics for the past week include Whitsun bookings. They compare with a normal week in 1934 and passenger train earnings are therefore substantially up. The passenger train increases in comparison with the Whitsuntide holiday bookings of 1934 are: L.M.S.R. £33,000, L.N.E.R. £34,000, Great Western £16,000, and Southern £24,000. In merchandise earnings the variations on Whitsuntide of 1934 are: L.M.S.R. + £4,000, L.N.E.R. + £1,000, Great Western + £3,000, and Southern - £11,000. Coal class traffics show the following changes in comparison with Whitsuntide, 1934: L.M.S.R. + £2,000, L.N.E.R. - £5,000, Great Western + £4,000 and Southern - £5,000.

	23rd Week				Year to date.	
	Pass., &c.	Goods, &c.	Coal, &c.	Total.	Inc. or dec.	%
L.M.S.R.	.. + 140,000	+ 2,000	+ 27,000	+ 169,000	+ 272,000	+ 1.08
L.N.E.R.	.. + 70,000	+ 2,000	+ 9,000	+ 81,000	- 48,000	- 0.26
G.W.R.	.. + 55,000	+ 7,000	+ 3,000	+ 65,000	+ 45,000	+ 0.43
S.R.	.. + 54,000	- 8,000	- 1,000	+ 45,000	- 8,000	- 0.098
	* * * *					

#### Railway Rates Tribunal Report

The recently-issued thirteenth annual report of the Railway Rates Tribunal covers its proceedings during 1934, which is notable as the first year in which agreed charges under the Road and Rail Traffic Act, 1933, received the approval of the tribunal. During the year 184 applications for agreed charges were lodged with the tribunal. Of these applications 148 were heard and determined, 3 were withdrawn during the year, and 33 remained pending at the end of the year. Notices of objection were filed to a number of the applications but only in one case—for approval of a charge agreed with F. W. Woolworth & Co. Ltd.—was the opposition pressed at the hearing. In no case was approval sought or given for a longer period than one year and in every case it was a condition attaching to the agreed charge that the trader would give to the railway company the whole or a stated minimum of the traffic specified in the agree-

ment subject in a number of cases to certain exceptions. The most general of these exceptions were that the trader retained liberty (a) to make local deliveries within a certain distance of his premises by road—usually in his own vehicles; (b) to use the parcels post for small parcels normally so conveyed; and (c) to employ coastwise shipping for traffic normally sent by that means. The jurisdiction of the tribunal under the London Passenger Transport Act, 1933, has not yet been invoked, and no applications under the Railway (Road Transport) Acts, 1928, were made to the tribunal during the year.

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#### Kowloon—Canton Railway (British Section)

Receipts of the British Section of the Kowloon-Canton Railway in 1934 were the highest recorded and reached \$1,639,775. This figure would have been \$1,671,088 had not the percentage earnings from terminal through traffic been reduced during the last quarter of the year from 35 per cent. to 28 per cent. in consequence of the new working agreement for through traffic between the British and Chinese sections of the railway. The British Section of 22 miles from Kowloon opposite Hong-Kong meets at Shum Chun the Chinese Section of 89 miles running thence to Canton. Traffic features of the year were the growth of terminal through traffic and the decline of local and sectional through traffic. Coaching traffic between Kowloon and Canton exceeded the million passengers mark for the first time in the history of the railway, and the tonnage of goods passing between the terminals exceeded the previous yearly maximum by two-thirds. Notable operating features of the year were the speeding up of the Kowloon-Canton through expresses and the introduction of fast midday trains, and there has been a marked advance in operating efficiency. Greater mileage per engine has been obtained, more miles have been run per engine hour, and the ratio between train and engine mileage has been increased. Net operating revenue was \$696,604 (against \$711,052) and would have been \$727,917 but for the alteration in the terminal percentage. After making provision for all interest charges on loan and special expenditure, the net surplus for 1934 was \$105,053.

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#### P.O. and Midi Railways

Under the working union of the Paris-Orleans and Midi Railways which came into force on January 1, 1934, each company maintains its own identity and issues its own report, but many of the traffic figures are shown for the combined system only. Operating details and the progress of electrification were dealt with in THE RAILWAY GAZETTE of April 19, 1935. In 1933 the Orleans had net receipts of fr. 131,382,489, but the Midi showed a loss on working of fr. 55,954,461, and the operating results of the combined system for 1934 show a decided improvement due to further economies and in spite of a fall of 3.02 per cent. in traffic receipts. Dividends on the ordinary shares remain the same as in 1933, namely, fr. 62 for the Orleans and fr. 50 for the Midi. The amounts required from the Common Fund by the Orleans were fr. 346,825,131 in 1933 and fr. 313,709,896 in 1934, and the corresponding figures for the Midi were respectively, fr. 400,495,925 and fr. 341,573,996.

1934		1933	
	Francs		Francs
Kilometres open ..	11,701	Passenger receipts ..	600,771,022
Passengers ..	80,380,737	Grande vitesse ..	368,039,074
Petite vitesse goods, tons ..	25,222,515	Petite vitesse ..	1,230,268,569
Train-kilometres ..	88,395,904	Total receipts ..	2,249,105,676
Operating ratio, per cent. ..	92.03	Total expenses ..	2,069,812,989
		Net receipts ..	179,292,687

#### Accidents to Railway Servants

The Assistant Inspecting Officers of the Ministry of Transport held 32 inquiries into the more serious accidents to railway servants during the three months ended September 30 last, of which 17 were fatal cases. The inquiries were distributed among the various companies as follow (the number of fatal accidents is added in brackets): Cheshire Lines Committee 1; G.W.R. 1 (1); L.N.E.R. 12 (4); L.N.E. and L.M.S. Joint 1 (1); L.M.S.R. 8 (4); Midland and G.N. Joint 1 (1); Southern Railway 8 (6). Of the 17 men killed 8 were employed in the permanent way department and the remaining nine were one each from the following grades, given in the order in which their cases appear in the reports: private firm's shunter, storekeeper, driver, fireman, stationmaster, shunter, porter, lampman, police constable. One of the permanent way men was acting as a look-out man and another was killed whilst playing football on some sidings in his dinner hour. In three of the fatal cases it was considered that the accident was due to misadventure, and in one to an error of judgment. In all the remaining fourteen cases it was judged that there was a want of care, but in one that conclusion was modified to "momentary carelessness," and in another to "momentary thoughtlessness."

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#### Blue Lights for "Line Clear"

Considering that the number of fundamental messages in connection with running movements required to be conveyed to engine drivers by signals is comparatively small, it is surprising how many kinds of signal aspect have been devised to do it and how difficult it seems to arrive at general agreement on the matter. This arises partly from the fact that anyone who has seriously worked out a system of his own is naturally convinced of its entire suitability, while when once signal aspects are in use it is both awkward and expensive to change them. Any alteration, too, must necessarily be governed by the characteristics of the existing arrangements which, save in the simplest cases, cannot be transformed at one stroke, or confusion, with its attendant dangers, will be caused. To this must be attributed the complications seen in the signal aspects of some countries, where new suggestions are still being advanced. Herr Grünwald, of Darmstadt, now proposes to use blue lights for "line clear" and green for certain warning indications. Blue, it is true, has not been found to be a suitable colour hitherto, except for subsidiary purposes, but he suggests that present day knowledge should enable us to produce a blue light of sufficient power and distinctive appearance. Even were this to prove so, to give green a warning meaning now would lead to complications, and we fear there is little prospect of Herr Grünwald's ideas being found acceptable in Germany or elsewhere.

\* \* \* \*

#### Striped Signal Posts

As announced in our news columns on June 7, the L.M.S.R. is to paint its tubular steel signal posts in alternate black and white bands, similar to the road traffic light and pedestrian crossing posts, to render them as conspicuous as possible. This method of painting has long been customary in several Continental countries, such as Sweden, Germany, Holland, and Switzerland, where, in any case, wooden posts were seldom seen. Alternate bands of red and white were popular for stop signal posts, and green and white bands were often seen on distant signals. On the former "S.S." or State Railways, system in Holland, those signals which applied

to both running and shunting movements had red and white posts; those applying only to running movements had black and white posts. The practice of using certain of the ordinary semaphore signals in connection with shunt movements began with an installation at Utrecht in 1893, the special painting being introduced in 1898. At the present time the Netherlands Railways use yellow instead of white bands on signals to which special rules apply for wrong line running. In Germany, where there are many lattice, as well as solid, steel posts, the practice has sprung up of painting them grey all over and fitting enamelled red and white plates on the front, simplifying the painting and enabling the distinctive colouring to be readily kept bright.

\* \* \* \*

### Rail Fissures in U.S.A.

As yet the rail fissure trouble in the United States shows no tendency to decline but rather increases. Statistics presented to the recent convention of the American Railway Engineering Association show that the accumulated grand total of fissure failures up to the end of 1933—the latest period to which detailed information is available—amounted to 74,405, of which the year 1933 accounted for 9,124. The figure last-mentioned is an increase of 2,070 over that for 1932; there were 2,231 more rails removed from the track in 1933 than in 1932 in which the fissures had been detected before failure, and 166 fewer failures of rails in which the presence of fissures had not been detected. It is an encouraging sign of the efficiency of the detection methods now being applied, however, that in 1933, for the first time on record, the number of fissures detected in time, totalling 4,661, exceeded by 198 the number of rails, totalling 4,463, breaking in service as a result of transverse fissuring which had not been discovered before failure. As regards failures, from all causes, of rails rolled in 1928, in the first five years of their life there were in all 76.4 failures per 100 track miles, a decrease of 36 on the figure for 1927 rollings, which of course includes an additional year. The general trend is thus in the right direction, even though the record is far from satisfactory; indeed, 76.4 per 100 miles is the best figure that has been obtained in regard to the rollings of any year since those of 1914, which works out at 74.0 per 100 miles.

\* \* \* \*

### New Works on the Mersey Railway

The interesting engineering work that, as described on page 946 of our issue of May 10, is being done in the Liverpool Central, Low Level, station of the Mersey Railway, has the unusual feature of being carried out without Parliamentary sanction. Under section 16 of the Railways Act, 1921, the Minister of Transport can issue an Order permitting a railway company to carry out "minor alterations and extensions and improvements of existing works," provided that their cost does not exceed £100,000. Under the Railways (Authorisation of Works) Act, 1923, the limiting amount was increased to £500,000. We would remark, in passing, as illustrative of the benefits of these facilities, that the Minster curve and the Hundred of Hoo branch of the Southern Railway were constructed under Ministry of Transport Orders. Of perhaps equal interest is the fact that at this station the Mersey Railway has some points that are automatically worked by a train when it stands on a relevant track circuit. That was a sequel to the provision of automatic signalling for the under-river section in November, 1921, which was so satisfactory that it was extended during the following year. At the same time automatic control of the points was installed, whereby a train arriving from Birkenhead in No.

2 platform road opened the points to admit itself into No. 1 siding; when within the safety points the points were reversed and the train could leave No. 1 siding and enter No. 1 platform road, ready to leave again for Birkenhead. That allowed signal box A to be practically dispensed with. Later, the crossover-road at the other end of the station, by which trains in No. 2 platform road could at once reverse and leave for Birkenhead, had its points similarly controlled, which allowed signal box B to be closed at periods when No. 2 road could deal with all the trains. A similar automatic operation of points is to be found at Barking and Wood Green and at two suburban stations on the Victorian Government Railways.

\* \* \* \*

### Mechanised Permanent Way Maintenance

The extent to which the use of machinery has become general during the last few years in permanent way maintenance is seldom realised. Besides the bigger and better known plant such as is used for welding, tamping, relaying and so on, the use of small power driven tools has steadily grown. Whereas until about ten years ago the usual method of cutting and drilling rails for ordinary repairs in the track was by hand, the modern method, especially on lines where traffic is dense, is by means of power driven saws and drills, the power being obtained either by means of small portable petrol engines, or, where electric current is available, from that source. On another page we illustrate several of these applications by means of which the time taken to pierce a hole through a standard 95-lb. rail has been reduced from the 20 minutes occupied in drilling by hand ratchet to two minutes. To cut through a similar rail used to take from 40 to 60 minutes by hand, whereas the power driven saw will do the same work in 8 to 12 minutes. The saving in time to drill holes in timbers for the fixing of chairs is less important, but, even so, where there are many holes to be drilled, the accumulative saving is appreciable. There are, of course, quite a number of other applications for these small portable engines and their field of usefulness is steadily increasing.

\* \* \* \*

### A New Steam Railcar Locomotive

There have, of course, been many instances of railcars propelled by steam locomotives of different types and designs both in this country and abroad, some of them incorporating a steam engine of the normal kind and a passenger car on the same framing, and others having high speed engines with multi-cylinders driving a common shaft. In addition there is the motor train in which a tank engine of normal design is used for push-and-pull service. The type of railcar recently introduced on the Austrian Federal Railways is something very different from any of these, incorporating as it does a 2-4-2 type tank locomotive carrying on its frames a special built-in compartment for luggage and goods consignments of the lighter kinds. This new type, which is described and illustrated on pages 1164-5 of the present issue, is built with sufficient tractive effort and speed to meet the requirements of quick suburban service with light passenger trains, and to perform this work on a more economical basis than has hitherto been possible with a somewhat larger type of engine working in the ordinary way. The locomotive is so constructed that it can be operated by one engineman only, but in order to comply with the regulations laid down by the Ministry of Commerce and Traffic, the regulator, reversing gear and brake handles have been arranged so that they can be operated from either side of the footplate. Both oil and coal firing are provided and there are many other interesting details in the design.

## The Government and Railway Works Schemes

THE decision of the Government to utilise the national credit in order to facilitate the improvement of London's rail transport facilities has met with general approval. The scheme is one of very great importance, not only to the various railways concerned, but to industry in general, for it provides for an expenditure of about £35,000,000 within the next five years, and will give a large amount of employment not only in London but in the iron, steel, electrical, and a number of allied industries in many parts of the country. The intentions of the Government with regard to the provision of the loan which is to be issued under its guarantee have not yet been revealed, but arrangements will doubtless be made to spread the repayments over a period of possibly fifteen or twenty years. This arrangement is essentially different from that adopted under the Development (Loan Guarantees and Grants) Act, 1929, where works were actually financed by the companies, but assistance given by the Government in the shape of a grant of interest for a period not exceeding fifteen years on the capital expenditure involved.

The present scheme does not involve any such grant to the companies concerned; it merely utilises the high level at which the Government credit now stands for the purpose of guaranteeing loans carrying a lower rate of interest than the companies would be able to secure themselves at the present time. These loans will be of sufficient magnitude to enable the London Passenger Transport Board and the railway companies to undertake at once a comprehensive scheme of works affecting London Transport, a substantial proportion of which would otherwise have to be deferred until more propitious times. The works undertaken under the 1929 Act and to be carried out under the present scheme all possess one highly important common factor, however, in that they will render valuable assistance in the direction of the alleviation of unemployment. In fact, therefore, the assistance of the Government in facilitating the raising of the necessary capital at a reasonable rate will also cause an appreciable diminution in the funds now being expended on unemployment benefit and public assistance, and will thus benefit the national exchequer in addition to providing a welcome fillip to industry and a wider circulation of money.

The inherent advantages of a scheme of this character are so important as to justify consideration being given to the possibility of extending the principle to other large public works of national importance. As Sir Robert Horne mentioned at the annual meeting of the Great Western Railway early this year, it is essential that large scale organisations such as railway companies should plan well ahead for future development. There are undoubtedly many other major works which could be undertaken by the railways but which, in present circumstances, it would be uneconomical for them to carry out owing to the loss of interest likely to be sustained on the capital expenditure involved during the period in which the works could not be fully remunerative. An extension of the existing scheme, or the introduction of some similar arrangement, in connection with other major railway improvement works, would obviously benefit the community in many ways. It would enable the national transport facilities to be improved, provide a valuable use for idle capital, considerably increase employment over a number of years, benefit our basic industries, and provide a widespread stimulus to trade and industry generally. Having regard to the fact that the scheme possesses so many advantages from the Exchequer point of view and does not involve

any draft on the national finances, it is to be hoped that some extension of the principle to other public works will be favourably considered by the Government and an announcement made at an early date.

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## A British Summer Speed-up

ELECTRICITY, steam, and the diesel engine all play their part in the improved summer train service programme of British railways, which is reviewed on pp. 1174-5 of this issue. Electricity is to provide the most revolutionary change, in the new Eastbourne, Bexhill, Seaford, and Hastings service of the Southern Railway. Although the quickest timing of 80 min. shows no reduction on the fastest times previously in force, the new hourly service, with certain additional trains, provides a total of 22 express trains from London to Eastbourne daily, from 8.45 a.m. to midnight, taking an average of 86½ min. on their journeys, as compared with but sixteen trains averaging 98½ min. in the present timetable. Four trains every hour between Brighton, Lewes, Eastbourne, Bexhill, and Hastings will also provide a coastal service without parallel in Great Britain. This introduction of electrical operation also has its reflex value in permitting the acceleration of steam-hauled services elsewhere on the Southern system. Just as the inauguration of electric traction to Brighton released sufficient locomotives of the "King Arthur" type to make possible a considerable quickening of the Kent Coast services, so the release from the Eastbourne services of "Schools" type 4-4-0 engines, with the additional engines of this type lately built, provides for a substantial acceleration of the Portsmouth service. For the first time on record, three expresses daily are scheduled to cover the heavily-graded 73½ miles between Waterloo and Portsmouth in 90 minutes.

On the Great Western Railway additional diesel railcars provide the element of novelty. Working on complicated rosters in the area between Oxford, Worcester, Hereford, and Birmingham, these cars will fill in various gaps in the existing services, and in conjunction with existing expresses between Paddington and Oxford, will furnish a new daily express service between London, Malvern, and Hereford. To and from the West of England a further development takes place in the long and successful history of the Cornish Riviera Express, which is to reassume its older title of Cornish Riviera Limited, and make no publicly-booked stop between Paddington and Truro, 279 miles distant. Falmouth, St. Ives, and Penzance portions only are to be carried. A second portion of the train, named the Cornishman, will run non-stop to Plymouth in 4 hr. New express services between Paddington and Worcester will provide Oxford with an afternoon express to Paddington in the even hour, additional to the morning train which already covers 63½ miles in the same time; and the down express, at the convenient hour of 10.15 in the morning, will run to Oxford in 65 min. Weston-super-Mare, Bristol, and Bath will also welcome the 25 min. speed-up of the first morning express to London, which is to cover the 94 miles from Chippenham to Paddington in 93 minutes.

But the most remarkable speed exploit of the summer timetables is the intention of the London & North Eastern Railway to run the Scarborough Flyer between King's Cross and York in three hours. Only last year 15 min. was cut from the schedule of this express, and 15 min. more is taken off this year, the result being that an average start-to-stop speed of 62.7 m.p.h. will be required of the locomotives, inclusive of the severe slowings through Peterborough and Selby. Although no reduction has been made of the time between York and Scarborough, the

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result of this Southern Area enterprise is, for the first time, to bring Scarborough within less than 4 hr. of London. And the value of providing fast service between London and the popular Yorkshire coast is witnessed by the fact that on Saturdays the Scarborough Flyer is to be run regularly in five parts. Another notable feature of the L.N.E.R. summer programme is the unprecedented provision made for fast travel between London and Scotland on Saturdays. From 9.20 a.m. to 2.30 p.m. inclusive, seven well-separated services will leave King's Cross for Edinburgh, of which the average journey time works out at no more than  $7\frac{3}{4}$  hr., or half-an-hour less than the minimum time of just over three years ago. A similar up service on Saturdays will bring Aberdeen within 10 hr. 50 min. of London, 45 min. less than the quickest time now in force; and it is to be hoped that means will be found to make such quickenings permanent, rather than a mere transitory benefit during the summer. The London Midland & Scottish Railway contents itself, in the matter of improvement, with the introduction of a down Fylde Coast Express, which cuts the London-Blackpool time by 33 min.; and with a valuable amplification of cross-country facilities, in conjunction with the Great Western Railway, by the express restaurant car services, twice daily, between Manchester, Cardiff, and Swansea, from 30 to 45 min. quicker in running than the best existing times.

In summing up these changes, it is worth remark that all the fastest of the new runs are made, not by the agency of electric or diesel propulsion, but by steam. Plenty of scope still remains, moreover, for further improvement. In our issue of May 3, a correspondent drew attention to the fact that Brighton was reached on an experimental run in 1903 with steam haulage in  $48\frac{3}{4}$  min.; the best time today, with modern electrification at command, is 60 min. An experimental steam run was made from London to Bournemouth in 1899 in 1 hr. 50 min.; in the new 1935 timetables the 120-min. schedule has been reduced to 118 min. To Birmingham the first regular two-hour train ran in 1900; two hours is still the best time by both the L.M.S. and G.W. routes, and the deceleration by 5 min. from this figure carried out in the case of several Great Western trains a few years back still appears in the timetables. Bristol was first reached in two hours from London as long ago as 1903; and this remains the quickest booked time over the same route. Even the special Saturday timing from Aberdeen to London already mentioned is 2 hr. 18 min. longer than the fastest time achieved in the summer of 1895. Furthermore, our issue of May 31 showed that over the three competing routes between Chicago and the Twin Cities of St. Paul and Minneapolis, varying in length from  $408\frac{1}{2}$  to 431 miles, the provision of three daily services all taking  $6\frac{1}{2}$  hr. has created so much additional traffic that one has had to be doubled daily, and one of the others has needed an addition of 50 per cent. to its accommodation—a striking witness to the truth of the contention that high speed pays. Similar facilities between London, Edinburgh, and Glasgow would bring the duration of journey down from the present "best" of 7 hr. 30 min. or 7 hr. 40 min. to  $6\frac{1}{4}$  hr. or so.

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### Bankruptcy Law for U.S.A. Railways

HOW the American railways can retain the support of investors despite a burden of debt and shrinking traffics is a problem which agitates both legal and political minds. Mr. Joseph B. Eastman, the Federal Co-ordinator of Transport, continues to make his painstaking analyses of the situation, but now seems to regard government ownership rather as an idealistic ultimate goal than a practical immediate solution. Such a step would not be

achieved without opposition, and Mr. Eastman may recognise that while many people are ethically disturbed at seeing the profits of a flourishing public service passing into private pockets, it would be subjecting their principles to too cruel a test were he to foist upon them the maintenance by increased taxation (as it would presumably have to be) of a failing concern. We learn from the "Forty-sixth Annual Report on the Statistics of Railways in the United States" (which is for the year ended December 31, 1932), that the dividends declared by the Class I systems in 1932 were \$236,224,551 less than in 1931, and \$412,698,590 less than in 1930. More recent figures are shown in the "Forty-Eighth Annual Report of the Interstate Commerce Commission" (dated December 1, 1934), but although there was a recovery in 1933, the proportion of stock paying dividends fell by 1.74 per cent. to 31.11 per cent., against a maximum since 1923 of 76.93 per cent. in 1930.

In viewing the situation as a whole it is easy to overlook the companies which have paid no dividends at all, and which are unable to meet their other liabilities. At the end of 1934 receivership proceedings were in progress in connection with forty-two railways, and five class I systems were awaiting reorganisation under Section 77 of the Bankruptcy Act. The purpose and practice of this legislation is surveyed in a monograph by Mr. Louis B. Wehle, reprinted from *The Yale Law Journal*. The Act is designed to safeguard the interests of stockholders in railway companies by giving them a more decided voice in the framing of plans for financial reconstruction. Either of its own accord, or at the instance of five per cent. of its creditors, a railway can invoke the custody of a Federal court, and, unless the application is voluntary, a plan of reorganisation will be recommended, after due hearing of proposals from the interested parties, by the Interstate Commerce Commission. The guidance of the commission throughout and the necessity of obtaining its approval before submitting a plan to court are regarded as the mainstays in the restoration of public confidence and a potent factor in securing its continued support of the railway by means of investments. Moreover, the stockholders receive unprecedented power in that, unless the creditors can convince the judge that the company itself agrees to the reorganisation plan, or that it is actually insolvent, the consent of two thirds of their number must be secured to any scheme submitted. This marks a radical departure from the normal process of bankruptcy law, whereby the foreclosure sale wipes out the stockholder who, to regain his interest in the concern, has to buy it with funds forming part of the capital of the new company. It should be borne in mind, of course, that the object of Section 77 is to avoid emergencies rather than to rebuild after they have exerted their effects.

In operation, the new process has proved tardy. The Interstate Commerce Commission in its last report complained that not one of the companies concerning which proceedings were pending had submitted reorganisation plans for approval during 1934. This is attributed to the fact that the railways involved were unwilling to place a value upon their share capital until an idea could be gained of how business would flourish in more normal times. The commission therefore recommends the enforcement of a time limit except in special cases. It is further suggested that the appointment of some recognised agency to determine whether or not a railway is insolvent would hasten the proceedings, since where insolvency is proved a reorganisation plan can be submitted direct to a Federal court, requiring neither acceptance by the stockholders nor the approval of the commission. Mr. Eastman has himself lamented the hesitancy of some railways in seeking the sanctuary afforded by the Bankruptcy Act. The granting of Reconstruction Finance Corporation loans

has continued, although the Interstate Commerce Commission has the power to veto such advances if it regards the applicants as financially unsound. The Federal Coordinator of Transport does not despair of a railway revival under private ownership, but recognises that the process will be slow and that the most urgent problem

is the provision of credit until prosperity is restored. Credit will be required for other purposes than the payment of debts, for Mr. Eastman considers that investors will require to be shown that the railways can effect improvements offsetting other forms of transport before they will again assist in their finance.

## LETTERS TO THE EDITOR

(The Editor is not responsible for the opinions of correspondents)

### Rimutaka and Friburgo Inclines

Leopoldina Railway Company  
Brazil, May 18

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—In your interesting article on the Rimutaka incline of the New Zealand Government Railways, published in the January 4 issue, the following words occur in the opening paragraph: "this is now the only section of railway in the world where a centre rail, operated on other than the rack principle, is in existence." I am, therefore, submitting for your information and that of your readers, a few facts concerning the Friburgo incline of the Leopoldina Railway (metre gauge), which, in addition to being longer and steeper, embodies engineering and operating features even more remarkable than those of the Rimutaka incline, although, as mentioned later, the centre rail serves purely as a means of braking in the descent.

Starting from the station of Bocca do Matto, at a height of 728 ft. above sea-level, the incline traverses one of the steepest portions of the Organ Mountains and terminates at the station of Theodoro d'Oliveira, 3,542 ft. above sea-level (giving a vertical rise of 2,814 ft.) and 7.64 miles from Bocca do Matto; the maximum gradient on the incline is 1 in 11 and the radius of the sharpest curve 1.4 ch. The corresponding figures relating to the Rimutaka incline are: (a) vertical rise 871 ft. (273 to 1,144 ft.); (b) total length 3 miles; (c) maximum gradient 1 in 13; (d) sharpest curve 5-ch. radius, so that in every essential detail it is surpassed by the Friburgo Incline.

Originally the track on the Friburgo incline was built on the Fell system, but certain imperfections manifested themselves on account of the inability of the auxiliary adhesion wheels, with their driving mechanism rigidly mounted on the locomotive frame, to follow any irregularities in the lie of the central rail, with consequent frequent fracture of the driving mechanism. As a result of this and other incidental disadvantages, the use of artificial adhesion was abandoned, and normal adhesion engines have since been used. As already stated, the centre rail is now used only for braking.

In 1929 two new locomotives were designed by the company and built by the North British Locomotive Company with a wheel-base of 9 ft. 8 in., the central rail steam brake being redesigned and sprung from the engine frame to allow for track irregularities; at the same time the weight on driving wheels was slightly increased, bringing the total weight in working order to 49 tons, compared with the 44/46½ tons of the remaining eight engines, built by the Baldwin Locomotive Works between 1883 and 1895. The two relatively modern Incline engines have had various additional improvements incorporated in the design, including superheating, Lentz poppet-valves, Walschaert valve gear and multiple valve regulator, with the result that not only has a 20 per cent. reduction in coal consumption been effected, but also the incline is negotiated with a greater degree of safety.

When ascending, a train is broken up at Bocca do Matto and is drawn up to the summit by ordinary adhesion in sections, engine-loads being limited to 40 tons per section for passenger trains and 44 tons for goods. The line actually starts to rise at Cachoeiras, 4.6 miles before reaching Bocca do Matto, continuing on an average grade of 1 in 42, and the practice is for one of the Incline engines to substitute the main-line engine at the former station and take the train in one section—except at holiday periods, when duplication of passenger trains is sometimes necessary—to Bocca do Matto; the same procedure is followed on the descent as between

Bocca do Matto and Cachoeiras, where the main-line engine takes the train on. When descending, a train is broken up at Theodoro d'Oliveira, the Incline engines taking over from the main-line engine at this point and bringing down sections which are limited to 90 tons for passenger and goods trains alike; the central rail, which is a bull-headed rail laid flat on chairs secured to longitudinal sleepers, is used for braking on



The "third rail" Friburgo inclined section of the Leopoldina Railway

the descent, being gripped by strong scissor-brakes on the engine and each rolling-stock unit.

Traffic on the incline is heavy all the year round, and more particularly during the summer months, when considerable numbers of people from Rio and Nictheroy travel to Friburgo and neighbouring mountain resorts, the loading of passenger trains during week-ends at the height of the summer frequently necessitating six or seven sections on the ascent. In the intervals between passenger trains, goods wagons are worked up and down throughout the day, so that for any Incline engine to stand idle between 5 a.m. and 10 p.m. for any length of time is a rare occurrence. Crossing-places, situated 3.5 and 5.7 miles up the incline, facilitate the movement of traffic at the busiest periods.

To sum up: although the mode of operation and technical characteristics of the two inclines are not identical, the foregoing particulars will serve to show that the Friburgo incline of the Leopoldina Railway possesses certain unique features, in addition to providing what is probably the steepest locale for ordinary adhesion working in the world.

Yours faithfully,

W. J. HUTCHINSON,  
Resident Engineer

## THE SCRAP HEAP

The ordinary life of a locomotive is said to be twenty years. No doubt it would live much longer if it did not smoke so much.

Mr. Justice Grantham used to tell the following good story against himself. On a train journey he asked a passenger who was smoking in a non-smoking compartment to extinguish his pipe. The man refused. Thereupon, handing him a card, the Judge said: "You see who I am. I shall take steps to deal with you."

At the next station the smoker left the train. Justice Grantham told a ticket collector to go after him and get his name and address. After a few moments the collector returned and gave the Judge a card, remarking as he did so: "If I were you, Sir, I should take no further notice. You'll see from the card that he's Mr. Justice Grantham." — From "The Morning Post."

The following verses are alleged to represent the reactions of the G.W.R. permanent way staff to a visit from the whitewash van described in our issue of February 15. It will be remembered that this vehicle is attached to the rear of ordinary express trains and is designed to shed a drop of whitewash at points where irregularities of the track cause oscillation to rise above a certain degree. The poem appeared some time ago in a local newspaper:—

### THE WHITEWASH TRAIN

The whitewash train! The whitewash train!  
Is running down our way again.  
And woe betide if joints are slack  
Mayhap we all will get the sack.  
Our nerves are simply on the rack.  
We chant a sad refrain.

The whitewash train! The whitewash train!  
We all have got it on our brain.  
Inspectors warn us "be prepared,"  
The ganger he is badly scared,  
Small wonder that he bawled and blared  
And shouted yet again.

The whitewash train! The whitewash train!  
It gives us quite a nasty pain.  
Sub-gangers pacing up and down,  
Their faces wear a worried frown,  
For should the rail be showing down  
They'll get a "Please explain."

The whitewash train! The whitewash train!  
Your beaters wield with might and main.  
All hearts are going pit-a-pat.  
The tea-nip and the cabin cat,  
The whole gang will be "on the mat,"  
And probably be slain.

The whitewash train! The whitewash train!  
Hurrah! It sped along the main,  
And did not leave a single splash,  
Therefore we do not care a dash,  
If our reward be not in cash,  
At least we breathe again.

The breadth of the American continent is still a source of complication in railway timetables, although not to the extent it was prior to 1880, when the United States kept 75 different local times. Today there are four time zones in the U.S.A., and five in Canada, and in both countries there is an extra source of confusion in the

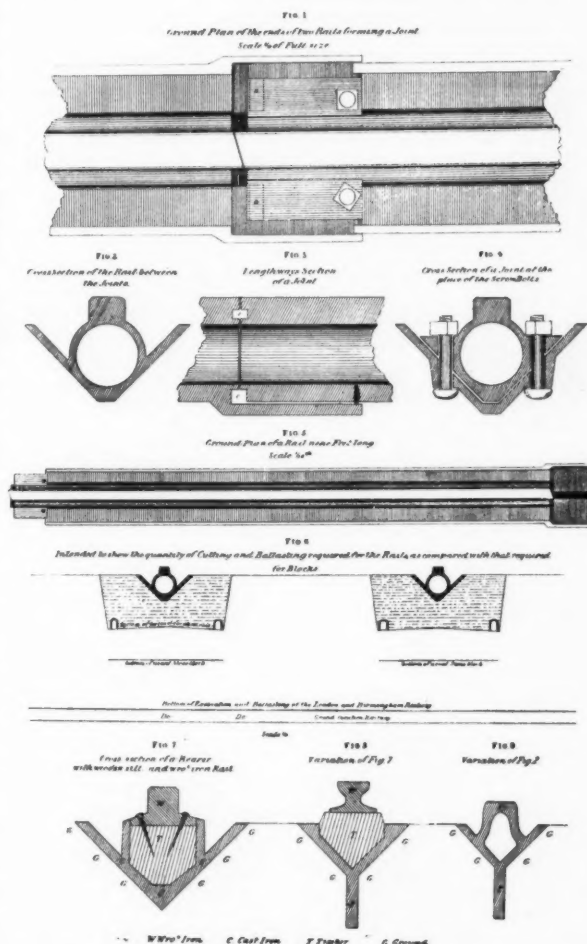
fact that summer time is optional and some areas (mainly towns) adopt it and others do not. The Canadian National Railways print a note in their timetables to the effect that standard times are shown throughout, and also give a list of the zones in which the five standard times—Atlantic, Eastern, Central, Mountain, and Pacific, are observed.

### EARLY RIGID PERMANENT WAY

The accompanying drawings are reproduced from *The Railway Magazine* of June, 1836, and illustrate a type of permanent way devised by a Mr. John Reynolds to afford "continuous and equal support to all parts of the rails by means of cast iron bearers, which rest throughout their length upon and in the ground, and are so connected end to end as to be equally incapable of a fracture at the joints, as at the intermediate parts." Rails shown in Figs. 1 to 6 were to be in lengths of 9 or 12 ft., and to weigh 150 lb. to the yd. In Fig. 7 is shown a modified type of track with the rail resting upon timbers contained within the casting. This track was to weigh 140 lb. a yd., the rails accounting for 40 lb. Fig. 8 shows a variation of Fig. 7 in which the bearer weighs 70 lb. and the rail 28 lb. a yd., and Fig. 9 a variation of Fig. 2 weighing altogether only 84 lb. a yd. Fig. 6 was intended to show how much less excavation and ballasting would be required for this type of track compared with the then normal stone block track. When Mr. Reynolds' invention was described in *The Railway Magazine* a trial length had been in service on the Liverpool & Manchester Railway for several months and had at the time of writing continued "to be perfectly firm,

straight and level without requiring any repairs." A further trial length of 45 yd. had been laid a little later on one of the weakest parts of Chat Moss, which had also at the time of writing been successful.

As nothing further seems to have been heard of this type of permanent way it may be assumed that it was overtaken by the same fate as has been met by all other attempts to devise a rigid form of permanent way at a cost anything like comparable with the flexible type now universal. Permanent way of the sort devised by Mr. Reynolds might be expected to stand up satisfactorily for a short time, but without doubt, due to the impossibility of maintaining a firm bed, it would become shattered. The only rigid permanent way we know of are the two short experimental sections laid down some years ago on the Pere Marquette Railway of America, but this is of immensely strong reinforced concrete construction and so far has seemed too costly in initial expenditure to be justified. This type of track was described and illustrated in *The Railway Engineer* for February, 1932.



An early form of rigid permanent way illustrated in "The Railway Magazine" of June, 1836

## OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

### INDIA

#### M. & S. M. Reorganisation

Important changes have been introduced as from April 1 in the organisation for the administration of the commercial and operating work of the Madras and Southern Mahratta Railway. Prior to that date, commercial, operating, and power functions were controlled by a single officer designated the Chief Transportation Superintendent and Traffic Manager, with the assistance of deputies. The commercial side of the department has now been entirely separated and placed under a Chief Commercial Manager, to which post Mr. C. G. W. Cordon, Deputy Commercial Superintendent in the old régime, has been appointed, with Mr. R. E. Nunn as his deputy. The operating and power functions will remain together under the Chief Operating Superintendent, Mr. R. De K. Maynard. It is claimed that the reorganisation will result in increased efficiency without any large increase in expenditure. Most of the large Indian railway systems have for some time past had separate commercial and operating departments.

#### Indian Trade

The working of the Ottawa Pact in India during the year ended March 31, 1935, is now being examined in the office of the Director General of Commercial Intelligence, and the resulting report will probably be considered by a committee of the Central Legislature. A feature of Indian trade during the past financial year lies in the reduced demand for and restricted entry of Indian produce into countries on the Continent of Europe. There are many in India who believe that this decline is due to deliberate retaliation on the part of those countries for the preference given in India to British manufactures in accordance with the Ottawa agreement. Be this as it may, reduced exports from India during the last six months of the year are held responsible for the set-back in railway earnings in this period.

#### Reflection upon Railway Earnings

Although the financial year closed with a substantial increase in earnings over the figures for the previous year, the progressive increase experienced in the first half of 1934-35 has not been maintained in the latter half. There have actually been periods when the weekly approximate earnings have fallen below the figure for the corresponding week of the previous year. Another factor contributing to the falling off in traffic is, however, the deferred booking of coal

and salt, coal on account of the early announcement of the reduction in freight surcharge from April 1, 1935, and salt because of the uncertain situation created by the Assembly voting for a reduction in duty, which was not finally accepted by the Government. The unsustained rate of improvement in traffics is thus due to many contributory causes, but mainly to fluctuation of world trade generally.

#### New Design of Third Class Carriage

The new design of third class carriage [referred to in THE RAILWAY GAZETTE of May 24.—ED. R.G.] includes provision for smaller compartments than hitherto, so as to accommodate family and other parties travelling together. The latest type of coach at present running has accommodation for 114 passengers in four compartments, with 12, 20, 30 and 52 seats respectively. Latrines are provided in each compartment. The new design accommodates only 96 passengers in six compartments of equal size, and each compartment will contain an improved type of latrine. A model of this design is under construction in the workshops of the G.I.P.R., and, when ready, will be sent to Delhi for the inspection of the Central Advisory Council.

#### Coaches Destroyed by Fire

Nine railway coaches were destroyed by a fire which recently broke out at the stock sidings of the Eastern Bengal Railway at Sealdah. Smoke was first seen issuing from the dining car attached to the Assam Mail rake, which had been shunted into the siding for the purpose of cleaning. The whole car was soon ablaze. Helped by a strong wind, the fire rapidly spread to two other coaches of the train and to six coaches of two empty rakes standing alongside. The Calcutta Fire Brigade promptly arrived on the scene and brought the conflagration under control in about an hour, but in the meantime damage to the extent of about Rs.2 lakhs had already been done.

#### Passenger Train Derailment

On the afternoon of May 9 the engine, a six-wheeled brake van and six bogie coaches of the 239 up passenger train on the metre gauge system of the Eastern Bengal Railway, left the rails at Salmari, a station on the Katihar-Golagganj section. The engine and the brake van capsized. Four railway employees, including the driver and two firemen, and fifteen passengers were injured. The injured were promptly removed to the railway hospital at Katihar, where all except

the driver, whose condition is serious, are making satisfactory progress. The line was blocked, involving the transshipment of passengers, but through running of trains has since been restored. The brake van was badly smashed. The cause of the derailment is not yet known.

### BRAZIL

#### Projected new Railway in Rio Grande do Sul

Early in April a party of engineers from the firm of W. Scott & Middleton Limited, in charge of J. Kershaw Middleton, flew from Santa Maria to Pelotas, in the State of Rio Grande do Sul, and returned to Santa Maria by motor-car, having made panoramic and topographical surveys of the route with a view to constructing a direct railway through the central portion of the state. The projected railway will serve the towns of Cangussú, Passo das Carretas, Camaquan, Sant Anna de Boa Vista and Caçapava which are at present linked up only by indifferent roads. It will also enable the circuitous journey of 548 km. between Santa Maria and Pelotas, via Cacequy, São Gabriel and Bagé, to be reduced to one of only 360 km. and the actual journey-time of 22 hours, involving long waits at Cacequy and Bagé, to be halved, thus benefiting travellers from Uruguayana and the Argentine frontier, and also Marcellino Ramos and the São Paulo-Rio Grande system to Pelotas and Rio Grande. On account of the difficult nature of the country, however, it is likely to be a number of years before the new line is opened for traffic.

### SOUTH AFRICA

#### Natal Main Line Improvements

Important and extensive realignment works are to be undertaken on the Glencoe-Volkrust section of this line with the object of improving curvature. They take the form of 22 deviations over 30 miles in aggregate length, and spread over 80 miles of line and the elimination of two reversing stations. The importance of the two latter measures needs no stressing, but they will necessitate the construction of three tunnels. At present only the survey and small construction works are in hand, but the labour that will be required for this extensive work will be supplied by the Labour Department of the Union, and very complete self-contained settlements are being prepared for the large number of men required. The work is expected to take about four years in all.

#### Capital and Betterment Expenditure

The total amount to be expended from loan and betterment funds in the financial year ending March 31, 1936, is £4,666,143, representing an increase of

£2,198,179 on the previous year. The amount is allocated as follows:—

Construction of railways	£ 90,760
New works on open lines	3,512,318
Rolling stock	113,659
Road motor services	87,200
Harbours	545,150
Airways	77,000
Working capital	40,056
Unforeseen works	200,000

A further sum of £5,631,421 will be expended from the renewals fund and £38,105 from working votes, making a gross estimated expenditure of £10,335,669. Among the more important works to be undertaken are:—

Electrification of the Witwatersrand.  
Doubling the line from Germiston to Pretoria.  
Remodelling and extending Kazerne (Johannesburg) goods yard.  
Colour light signalling Randfontein to Springs.  
Regrading and improvements between Glencoe and Volksrust in anticipation of electrification.

Further electrification of Natal main line.  
Doubling and quadrupling certain sections of the Reef lines.

During the financial year more than £2,000,000 will be spent on new rolling stock, additions, and improvements.

## EGYPT

### First Excursion Trains for an Unknown Destination

On April 29, the occasion of Sham El-Nessim, two excursion trains, the first of their kind to run in Egypt, left Cairo for an unknown destination. The fare charged was 10 piastres a head (3s. 2½d.). Some 2,106 passengers travelled on these two trains, and so popular was the idea, that about 3,000 were turned away. The trains ran to Ismailia, a distance of 158 km. from Cairo and returned in the evening, so those who speculated on this venture got good value. The receipts were £E.336,960 m/ms., and the expenses £E.58,900 m/ms., giving a net profit of £E.278,060 m/ms. A lottery ticket was given away with each ticket sold, and three out of every hundred bore lucky numbers entitling their holders to a free trip to Alexandria on the sea-side excursion trains, which will be re-inaugurated shortly.

### Comparison of Courban Bairam Bookings of 1934 with 1935

In 1934 the Courban Bairam fell from March 26 to March 29, whereas this year it fell from March 15 to March 18, roughly ten days earlier. The combined results for the 2nd decade and 3rd decade of March are therefore taken as a basis of comparison, in the table below.

SECOND AND THIRD DECADE OF MARCH, 1934 AND 1935

	First Class		Second Class.		Third Class.		Total.	
	Tickets.	L.E. m/ms.	Tickets.	L.E. m/ms.	Tickets.	L.E. m/ms.	Tickets.	L.E. m/ms.
1934..	27,857	9,194,330	99,012	18,788,250	1,506,590	78,332,750	1,633,459	106,315,330
1935..	25,051	9,167,615	95,752	18,259,015	1,440,576	73,946,295	1,561,379	101,372,925
Increase	—	—	—	—	—	—	—	—
Decrease	2,806	26,715	3,260	529,235	66,014	4,386,455	72,080	4,942,405

## FRANCE

### P.L.M. Door-to-Door Transport

Since 1933 the Paris, Lyons and Mediterranean Railway has developed extensive door-to-door services for transport of passengers' luggage and goods, including goods in bulk and liquids in tank wagons. Collection and delivery of express, postal and farm produce parcels by fast or slow goods trains are undertaken for virtually the entire P.L.M. system, including rural districts remote from railways. The arrangements necessitate agreements with road carriers, and are independent of the co-ordination plans.

Most of this development is the work of the last two years. Early in 1933 the P.L.M. was issuing combined rail and road passenger tickets for through travel to only 20 localities remote from the railway but served by buses. Little more than two years later the 1,800 stations of the P.L.M. were issuing combined rail and road tickets to 1,543 villages. These places are all listed alphabetically in the railway timetables (Indicateurs Chaix), and in each case the name of the nearest railway station is given, together with the time of the bus, price of the bus ticket, and cost of registering luggage through.

### Luggage Registered in Villages

Travellers from the villages toward the railway may obtain through tickets and have luggage registered to any station on the line by giving 24 hours' notice to the local bus office. Besides extending the rural passenger services, the P.L.M. also endeavours to ensure door-to-door delivery of parcels for the country, but where this is not feasible the parcels are left to be called for at the nearest dépôt. Express delivery service has been extended to 887 towns or villages having railway stations, whereas formerly there was only a partial service to 484 localities. Parcels arriving by train are delivered within 12 hours at the latest. Orders by telephone to the station to call for parcels from any address are executed within 12 hours. In the larger towns, several parcels dépôts are arranged. Parcels may be left there, and are collected at frequent intervals.

In the country districts many road carriers have signed "rural domicile" contracts with the P.L.M. Once or twice a day the carriers pick up parcels at the rural dépôts, and convey them

to the stations. According to the *Chronique des Transports*, there were 2,037 such dépôts in existence on March 1. The carriers also undertake delivery of parcels coming from the railways. Formalities for these operations have been greatly simplified in connection with parcels payable on delivery, consignments by fast or slow goods trains and express or farm parcels.

## DENMARK

### Aftermath of the Little Belt Bridge Opening: Disposal of Ferries

As a result of the opening of the Little Belt bridge, already described in these columns, in the issue of May 24, the six ferries previously used to connect Fyn with Jutland at the Fredericia-Strib crossing became spare, and, on the morning following the opening, all six left Fredericia in formation for Strib. After a brief closing ceremony there, the two most modern vessels proceeded to Masnedø, where they will be used until the Storstrom bridge is completed early in 1937. The other four ferry steamers are to be broken up. Both the ferry harbours are to be dismantled as are also the adjoining stations. At Fredericia a few sidings at the harbour will be retained and a small goods station at Strib. A single track will remain in place of the old main line from Middelfart to Strib, but the passenger service will be carried by railway-owned buses.

### The State Railways' Budget for 1935/36

For the year ending March 31, 1936, the State Railways expect a surplus on the working—for the first time in many years. The working expenses are calculated at 105.7 million kroner and the receipts at 109.3 million kroner, thus giving a surplus of 3.6 million kroner. The charges for depreciation amount to 6.55 million kroner, which must partly be covered by the State. The expected improvement as shown in the budget is the result of the electrification of the Copenhagen suburban services, the general improvement in trade, and the purchase by the State Railways of many bus routes. But the main cause is the opening of the Little Belt bridge on May 15, and consequent elimination of the six ferry steamers which were very costly to run. In fact, it is anticipated that the closing of the ferry service will effect a saving of over 2 million kroner yearly.

## FORMOSA

### Earthquake Damages

A rough estimate of the damage to railways, bridges and roads as a result of the earthquake in the island of Formosa (Taiwan) in April, is put at about Y. 4,000,000 (about £300,000 at current rate of exchange).

## OUR CENTENARY—MESSAGES FROM READERS

*As announced in our May 3 issue, "The Railway Gazette" and the journals incorporated with it have completed 100 years of continuous publication*

**T**HE following is the sixth instalment of the many messages we have received in connection with the centenary of THE RAILWAY GAZETTE and the various railway journals now incorporated with it, the earliest of which made its first appearance on May 1, 1835. In expressing our thanks to all who have written, may we say how greatly we value their appreciative and encouraging messages.

**Brig.-Gen. Sir Frederic Williamson, C.B., C.B.E.,  
Director of Postal Services, St. Martin's Le Grand,  
E.C.1.**

On behalf of the Postal Services Department, General Post Office, I offer you hearty congratulations on the occasion of the completion of 100 years of publication of THE RAILWAY GAZETTE. In view of the long and close association between the Post Office and the railway companies, I have for many years been a regular reader of the GAZETTE, and have always found it of the greatest interest. Moreover, to the interest is added the pleasure derived from the reading of a well-arranged and excellently illustrated publication.

**Mr. J. A. C. Jones, Chief Accountant, South African  
Railways and Harbours, Johannesburg.**

It gives me great pleasure to join in the numerous congratulatory messages which I am sure will be received by THE RAILWAY GAZETTE on the occasion of its centenary celebration.

THE GAZETTE has made for itself an abiding place in railway affairs not only in Great Britain but throughout the world and helps us all to keep abreast of developments in countries other than our own. In this way its usefulness cannot be over valued. I therefore wish for THE RAILWAY GAZETTE many years of continued prosperity and usefulness.

**Mr. W. R. C. Forster, Managing Director, The Westinghouse Brake Co. of Australasia Ltd., New South Wales.**

We note with much interest that THE RAILWAY GAZETTE completed 100 years of continuous publication in May. THE RAILWAY GAZETTE has done much to keep engineers abroad informed on modern railway practice, and we congratulate you on the success you have achieved.

Naturally we are most interested in particulars of brake equipment applied to rolling stock of all descriptions, and from our point of view, we would appreciate more technical detail in connection with braking matters.

**Monsieur le Directeur, Chemin de Fer du Bas-Congo  
au Katanga, Brussels.**

Nous avons l'honneur de vous presenter nos vives félicitations a l'occasion du centenaire de la création de votre très intéressante revue THE RAILWAY GAZETTE.

Nous saisissons cette occasion pour vous faire part du grand intérêt que nous portons a votre publication pour son abondante documentation sur tous les progrès réalisés en matière de chemins de fer et pour ses nombreux articles sur les transports aux Colonies. Nous souhaitons a votre revue une longue existence encore pour le plus grand bien de tous les organismes qui s'occupent de transports par rail.

[We have pleasure in sending you our warmest congratulations on the occasion of the centenary of your very interesting journal, THE RAILWAY GAZETTE.

We take this opportunity of informing you how greatly we are interested in the abundant information on all railway progress and in the numerous articles on Colonial transport contained in your review. We wish it a long future, to the greatest good of all organisations connected with railway transport.]

**Verkehrswirtschaftliche Rundschau, Vienna.**

Die Hundertjahrfeier des Bestandes Ihrer ausgezeichneten und interessanten Eisenbahnfachzeitschrift veranlasst uns, Ihnen unsere Wärmsten Glückwünsche für eine gedeihliche Zukunft Ihres Blattes auszusprechen und daran die Erwartung einer weiteren gegenseitigen nutzbringenden Zusammenarbeit zu knüpfen.

[The completion of the centenary of your distinguished and interesting railway newspaper prompts us to offer you our warmest congratulations for a prosperous future for your journal, and the anticipation of a further extension of mutual usefulness.]

**Mr. L. G. W. Hill, Acting Agent, Bengal-Nagpur Railway Co. Ltd., Calcutta.**

Hearty congratulations to the proprietors and staff of THE RAILWAY GAZETTE on the occasion of their completing 100 years' continuous publication. The features of your paper which we consider most interesting, among which it is difficult to choose, are the technical articles dealing with designs and performances of steam locomotives, and new systems of signalling. The supplement on diesel railway traction is also attracting special attention.

**Mr. E. C. Simpkins, M.B.E., formerly General Assistant to the Superintendent of the Line, Great Western Railway.**

Having been a regular reader of THE RAILWAY GAZETTE for more than 30 years, may I convey heartiest congratulations on completion of a century of continuous publication?

THE GAZETTE always contains valuable and reliable information, interesting alike to readers in active service or after retirement. Its widespread activities often amaze me, as the journal, whilst universal in character, gives concise and essential details of homeland matters of moment.

Best wishes for the next 100 years.

**Mr. Kenneth Cantlie, Ministry of Railways, National Government, Republic of China, Nanking.**

The life of THE RAILWAY GAZETTE which, with its incorporated journals, now celebrates its centenary, is almost contemporaneous with the life of railways themselves. The likeness does not end there, for does not the sonorous list of incorporated papers remind one irresistibly of a grouped railway? And did not the fluctuating fortunes of these papers resemble, and to some extent follow, those of the railways themselves? The grouping of these papers took place not by a sudden convulsion, but in easy stages; not by an unconscious experiment into "planned economy"; not as an end in itself; but as a step to still greater things.

China's reverence for age is well known and there are few, if any, of China's railways which THE RAILWAY GAZETTE does not reach. The journal is, therefore, certain of many expressions of good-will, and congratulations are extended to the editorial staff for turning out a journal which has emerged as the world's leading railway journal. Best wishes for the future!

**Mr. J. H. Smeddle, O.B.E., formerly Locomotive Running Superintendent, North Eastern Area, L.N.E.R.**

May I offer my congratulations upon the centenary of your papers. Your GAZETTE was always looked forward to when I was in harness, and I still enjoy reading it. The subjects are always interesting and give useful information on railway matters. I hope you may have many years to guide the paper you have so long been in charge of.

## THE HORSE-POWER OF LOCOMOTIVES—ITS CALCULATION AND MEASUREMENT—III

By E. L. DIAMOND, B.Sc. (Eng.), A.M.Inst.C.E., A.M.I.Mech.E.

*This is the third of a series of articles giving a critical account of the work that has been done in various parts of the world on a subject that today has acquired a new importance in view of the competition between the steam locomotive and other methods of railway traction. The previous articles appeared in our issues of April 12 and May 3.*

### EARLY ATTEMPTS TO EVOLVE SCIENTIFIC BASIS OF TESTING

The first attempts to put the testing of locomotives on a really scientific basis were those of Borodin and Loevy in Russia, and of Desdouts in France. In order to understand the significance of their work it is necessary to examine the underlying causes of the "baffling contradictions" referred to by *The Engineer*.

There are three bases of measurement of locomotive horse-power:—

(1) *Indicated Horse-Power*.—This can be directly measured and is uninfluenced\* by conditions of running. But it does not include the mechanical efficiency of the locomotive and therefore does not afford a basis for a complete evaluation of locomotive performance. Moreover no convenient direct method exists of integrating indicated horse-power during a test under variable conditions, and indirect methods are inaccurate, even if a large number of indicator diagrams be taken during the run.

(2) *Drawbar Horse-Power*.—This can be measured and integrated with a very high degree of accuracy by means of a dynamometer car. Railway managements like to have the performance of a locomotive expressed in terms of drawbar horse-power because it represents the power ultimately available for drawing carriages and wagons. But it is scientifically almost valueless as a basis of estimating locomotive performance because it excludes an unknown proportion of the work done by the locomotive in moving its own proportion of the weight of the train, which may actually vary between zero and 100 per cent. according to the load behind the tender, the gradient of the road, and the acceleration of the train.

(3) *Horse-Power at the Rims of the Driving Wheels*.—This corresponds to the brake horse-power of a stationary steam engine. It includes the whole efficiency of the locomotive as a machine for doing work. It does not include the resistance of the locomotive as a vehicle; that is to say it would not evaluate any merits a locomotive might have due to low journal resistance or to streamlining. But these are properly matters of train design as a whole, as is particularly apparent in the matter of streamlining, and it is logical that they should be included in the resistance of the train and not in the efficiency of the locomotive. On a stationary locomotive testing plant it is this horse-power which is measured, plus, however, the journal friction of the driving wheel axles which rotate. In road tests there is no direct method of measuring this horse-power.

The equation of motion of a train may be written as follows:—

$$F = \left[ \frac{P+Q}{g} + \Sigma \frac{I}{R^2} \right] \frac{dv}{dt} + P(w_p + i) + Q(w_q + i)$$

\* This statement is not strictly correct, but in considering the mechanical principles involved it may stand.

omitting the term for the elastic oscillation of the train, which is negligible.  $F$  is the force at the rims of the driving wheels of the locomotive, producing motion;  $P$  and  $Q$  are the weights of locomotive and train respectively, and  $w_p$  and  $w_q$  their respective resistances to motion along the track;  $dv/dt$  is the acceleration of the train,  $g$  the acceleration due to gravity, and  $i$  is the gradient.  $\Sigma I/R^2$  is the term giving the total inertia of the rotating wheels,  $I$  being the moment of inertia and  $R$  the radius of individual wheels.

Now if instead of the force at the rims of the driving wheels, the force at the drawbar be measured, the terms including the weight  $P$  of the locomotive must be omitted, and it is evident that unless the gradient and the acceleration of the train are known at the required moment, as well as the resistances of the locomotive as a vehicle, it is impossible to relate the performance of the locomotive, as expressed by the speed of the train and the weight of the carriages hauled, with its dimensional characteristics. If the gradient and the indicated horse-power be given, as in W. M. Smith's tables, it is still essential to know the acceleration of the train and the internal machine friction of the locomotive.

**The Belgian Method of Testing.**—Reference has already been made to the work of Desdouts with the dynamic pendulum. It was at the beginning of the 'eighties of last century that Desdouts became interested in the then newly invented "inertia ergometer," as it is generally known in England, and during the succeeding twenty years he published accounts of many investigations carried out with its aid, which included measurements of locomotive resistance.\* The dynamic pendulum is suspended in the dynamometer car and sets itself at an angle to the normal proportional to the accelerating force acting on the train in the direction of travel, *independently of the gradient*.† A recording mechanism causes the pendulum to scribe a curve, the ordinates of which, in the early form used by Desdouts, were proportional to the accelerating force. In the later forms of ergometer the mechanism is so arranged that the slope of the line described by the pen is proportional to the accelerating force.

This gives the sum of all the terms in the right-hand side of the equation of motion of the train except those due to the resistances of locomotive and train and the inertia of the rotating wheels. If, immediately after this measurement has been made for any particular speed, and before conditions have had time to alter, steam is shut off, the new rate of acceleration, which will usually be negative, will give the total resistance of the train. Thus, the equation of motion can be completely solved and the tractive force of the locomotive at the rim of the driving wheels determined, if the inertia of the rotating wheels be neglected.

Much later Doyen, chief engineer of the Belgian State

\* Nadal gives a list of references to Desdouts' papers, *Revue Générale des chemins de fer*, 1903, vol. 26, p. 285.

† On an incline the displacement of the pendulum from the normal under the static force of gravity is exactly balanced by the acceleration component in the direction of travel of the dynamic force of gravity. Thus if the train moves at a uniform velocity up a gradient, the ergometer registers an accelerating force equal and opposite to this dynamic component, which is due to the pull of the locomotive.

Railways, adopted Desdouts' proposals\* and developed them systematically into what became known as the Belgian method of testing. The tests were carried out under the variable conditions of an ordinary run, steam being shut off for a kilometre or so at a number of different speeds so as to enable the total work of the steam at the rims of the driving wheels to be calculated. Performance data based on this figure are truly comparable as between different locomotives,† and herein lay the great advantage of the Belgian method of testing over the customary method of integrating only the drawbar horse-power. The degree of accuracy attainable, however, is not very high. In the first place, the measurements of the ergometer itself are not very reliable. Another objection is that the total resistance of the train must necessarily be measured when steam is shut off, whereas what is required is the resistance when the locomotive is under steam. Finally, the inability of the method to measure the forces due to the inertia of the rotating masses constitutes a major inaccuracy.

The rolling resistance of locomotive and tender can easily be obtained by subtracting from the total resistance of the

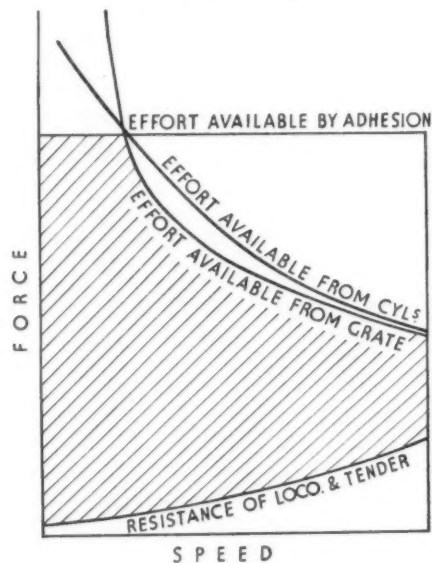


Fig. 4—Doyen's characteristic curves

train, as measured by the ergometer, the resistance of the carriages as measured by the dynamometer at the tender drawbar. The form of characteristic curve for a locomotive used by Doyen consisted of a curve of drawbar pull based on standard rates of fuel consumption per sq. ft. of grate area (Fig. 4). The standard rates were as follows, the figures being expressed in English units:—

56 lb. per sq. ft. of grate per hour at speeds below 25 m.p.h.	
65	37
84	50
107	62
121	75

The force at the rims of the driving wheels corresponding to each of these speeds was calculated by means of a constant value for the fuel consumption of the locomotive per horse-power hour measured at the rim of the driving wheels as determined from the trial results. The rolling

resistance of locomotive and tender was plotted on the same diagram, and the lengths of the ordinates lying between the two curves give the available pull at the drawbar. This was replotted as shown, using an adhesion factor of 6.5 as the limit at low speed.

This may appear at first sight a somewhat roundabout way of obtaining a drawbar pull curve, but it must be remembered that the fuel consumption per drawbar horse-power hour, as determined by means of the dynamometer integrator, cannot be properly used as an absolute basis of comparison, since it is dependent on the weight of the train and the grading of the track. This fact, which is sometimes insufficiently recognised, cannot be too strongly emphasised, elementary though it is. The Belgian curve of drawbar pull is actually equivalent to the modern German "corrected drawbar pull," that is to say, the drawbar pull on a dead level track.

The Belgian method of testing has never been very successful, however. It set about the chief problem in the wrong way; that is to say, it attempted the impossible task of taking account of the changing conditions during a test run, instead of stabilising those conditions and thus eliminating a highly complex tissue of cause and effect.

**French Indicator Tests.**—In later French experimental work the indicator diagram was taken as the main basis of study of locomotive performance, and in 1903 Nadal, the engineer of the French State Railway, commenced the publication of the results of a series of locomotive tests\* which included curves of indicated horse-power on a basis of speed, for various conditions of cut-off and steam chest pressure. In actual fact, however, these curves were largely hypothetical. As an inevitable result of the varying conditions under which the locomotives were running the indicated horse-powers plotted were erratic; moreover extrapolation was resorted to freely. It is for the latter reason that in some cases the curves show very high indicated horse-power at high speeds. Nadal recognised that the upper regions of some of his sets of curves lay outside the range of possibility. He mentions the limit of boiler performance but actually obtained a practical curve of performance by the somewhat arbitrary device of connecting up points corresponding to the falling steam chest pressure at increasing speed, obtained with a constant but restricted regulator opening. Nadal also carried out measurements of locomotive resistance by the method of rolling down a gradient.

Nadal's work is a good illustration of the inevitable limitations to what can be learned under the fortuitous conditions of road testing under ordinary service conditions, even when the effects of acceleration, gradient, and locomotive resistance are avoided by basing deductions upon the indicated horse-power.

**Sanzin's Austrian Tests.**—In Germany the search for a simple horse-power formula gave place to more intensive experimental work chiefly under the influence of Dr. Rudolf Sanzin, of the Austrian Railways, whose experiments were widely published in Germany. Dr. Sanzin made a special study of locomotive tractive effort, using the equation of motion of a train. He also carried out, like Nadal, extensive measurements of locomotive resistance by the method of rolling the locomotive down a gradient under the action of gravity,† and he proposed and used the same method for determining the resistance due to angular acceleration of the rotating wheels.‡ He pointed out that for this purpose it is only necessary to make two rolling tests at the same speed on different

\* Int. Railway Congress, 1911, vol. 25, p. 145.

† Except in so far as widely differing conditions may throw the bulk of the work of the locomotives compared into different regions of efficiency.

\* *Revue Générale des chemins de fer*, 1903, vol. 26, p. 285.

† Z.V.D.L., 1911, p. 1461.

‡ *Elektrische Kraftbetriebe und Bahnen*, 1919, pp. 81-7

gradients. It then follows from the equation of motion (page 1155) that

$$-w_p P = \left[ \frac{P}{g} + \Sigma \frac{I}{R^2} \right] \frac{dv_1}{dt} + i_1 P$$

$$= \left[ \frac{P}{g} + \Sigma \frac{I}{R^2} \right] \frac{dv_2}{dt} + i_2 P$$

where  $dv_1/dt$  and  $dv_2/dt$ , and  $i_1$  and  $i_2$  are the respective accelerations and gradients. Equating the two right-hand side expressions we have

$$\Sigma \frac{I}{R^2} = \left[ \frac{i_2 - i_1}{\frac{dv_1}{dt} - \frac{dv_2}{dt}} - \frac{1}{g} \right] P$$

The same gradient may be used if in the second case the locomotive or train is rolled up the grade instead of down.

Sanzin never actually attempted in his tests of locomotive performance to secure constant conditions, but he was fully aware of the sources of confusion and inaccuracy inherent in tests under variable conditions. He introduced the "equivalent drawbar pull" which is still used as the basis of characteristic performance curves in the modern German method of testing, and based his tractive effort curves\* on it. The equivalent drawbar pull is the drawbar pull which would be exerted for a given power output at constant speed on a level track, but whereas such conditions are actually approximated to in the modern German road tests, Sanzin had to calculate the equivalent drawbar pull from results obtained under unsteady conditions on a graded route. To do this he used the equation of motion of a train in the form

$$F_e = F_d + Q (\pm i \pm b) + (L + T) (\pm i \pm b)$$

where  $F_e$  is the equivalent drawbar pull on a level track at constant speed,  $F_d$  is the actual observed drawbar pull, or resistance of the train,  $Q$  is the weight of the train,

that they amount to about 8 per cent. of the total mass of the train, then  $b$  in kilogrammes per ton is given by

$$b = 0.1101\gamma$$

where  $\gamma$  is the acceleration in metres per second per second. He measured the acceleration by means of the tangent to the speed-time curve recorded in the dynamometer car. Such a method of measuring the acceleration is, of course, very unreliable, so that the allowance for the inertia of the rotating masses was perhaps a refinement more justified in theory than in practice.

Fig. 5 reproduces the curves obtained by Sanzin in 1905 for a four-coupled compound express locomotive. A curve of drawbar horse-power is included on this diagram, but in general Sanzin gave only the drawbar pull or tractive effort curve, and this has been the more usual practice in modern times, since the values of tractive effort are more convenient for the purpose of calculating train speeds and times. But the horse-power curve can, of course, be immediately obtained from the tractive effort curve by simple multiplication. It has the advantage of showing at a glance the most favourable speed, from the point of view of power output, for the locomotive concerned. Fig. 5 is of interest because it shows two tractive effort curves for the same locomotive and raises the problem of the criterion by which characteristic performance curves should be selected. Naturally a locomotive can exert a wide range of tractive effort at any given speed according to the regulator and cut-off positions. The lower curve is given by Sanzin as for average daily performance and the upper as a maximum performance. The distinction is an important one, and is still used today by many authorities, but such criteria lack any kind of precision. What exactly constitutes average daily performance may, and indeed does, vary considerably according to different administrations. Until the introduction of constant test

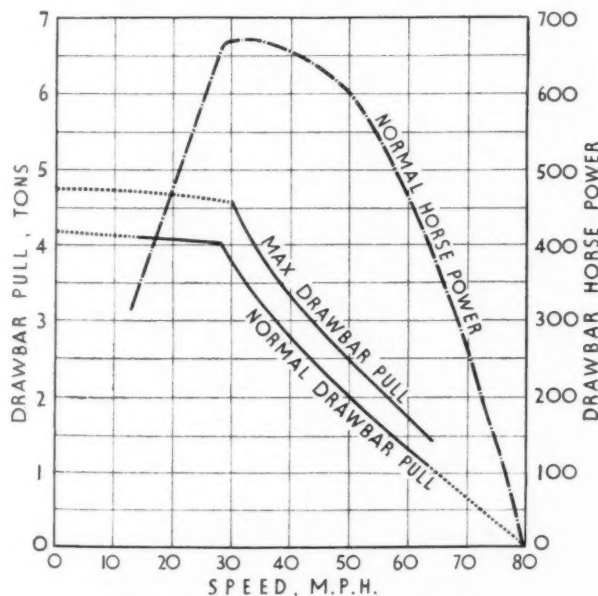


Fig. 5—Performance curves (Sanzin)

$L$  and  $T$  are the weights of locomotive and tender respectively,  $i$  is the resistance of the gradient per unit of weight, and  $b$  is the accelerating or retarding force per unit of weight. In calculating the last-mentioned value he allowed for the inertia of the rotating masses; assuming

\* Z.V.D.L., 1906, vol. 50, p. 118.

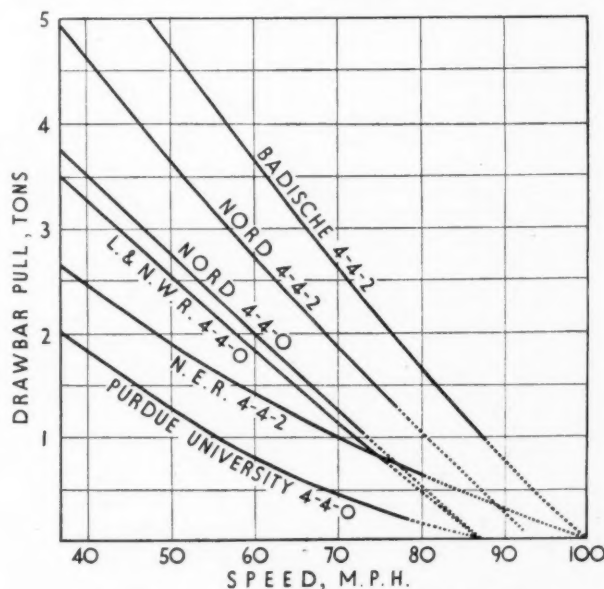


Fig. 6—Collated drawbar pull curves (Sanzin)

conditions it was impossible to establish any precise standard of operation on which to base such performance data, and even if such a standard had been envisaged, the prevailing conditions of testing involved so many inaccuracies and uncertainties that it could not have been put into practice. Curves of drawbar pull and speed, such as Sanzin's, obtained from ordinary road tests, are

therefore generally mean curves drawn more or less arbitrarily through widely scattered points, and are particularly uncertain in the upper region of speed. Thus, in the paper to which reference has been made, Sanzin included a diagram, reproduced in Fig. 6, collating the drawbar pull curves of a number of locomotives in the upper region of speed, from a variety of published test results. A mere inspection of these curves, in the light of our knowledge of the locomotives concerned, is sufficient to indicate that they are of little scientific value, and that the extrapolations in the highest region of speed bear no relation whatever to actual fact. Such a diagram as this embodies not only the margin of uncertainty of each individual road test, but the still greater uncertainty as between road tests carried out by different administrations under different conditions. Further, since the factors affecting locomotive power become increasingly uncertain as the

speed increases, extrapolation into a higher region of speed from a lower region is, as we have already seen in the case of Professor Dalby's curves, Fig. 2, really quite inadmissible.

Sanzin may be regarded perhaps as the last of the great locomotive experimentalists to work with the method of road tests under variable conditions. His work was not merely comparative, but comprised a systematic study of locomotive performance and efficiency.\* He was also a pioneer in the working out of systematic diagrams for the calculation of train speeds and times on various gradients, based on his locomotive tractive effort data. His work had a beneficial influence on the somewhat theoretical trend which the study of locomotive horse-power had hitherto tended to take in Germany.

\* See, for example, article on "Der Wirkungsgrad der Dampflokomotiven," Z. des österr. Ing. und Arch. Vereins, 1910, p. 725.

## A NEW CARRIAGE VENTILATOR

**A**IRVAC LIMITED, of Honeypot works, Darlington, whose ventilators enjoy a world-wide reputation, is placing on the market the Nuvac ventilator after tests which have been conducted during the past two and a-half years. This device was designed to provide a high-grade ventilator at a moderate price, its application to third class rolling stock in tropical countries being especially envisaged.

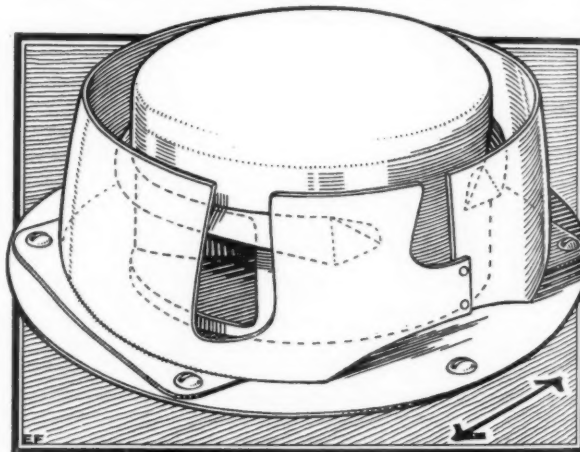
The Nuvac ventilator is made in one size only, but in order to make the complete unit adaptable to all classes of railway rolling stock and public vehicles, four being suitable for 5-in. dia. roof apertures and three for 7½-in. apertures. All are circular fittings varying from plain grilles to grilles with shutters and those equipped with a flush-fitting electric roof light; the fittings are made in overall diameters of 6 in. and 9 in. Great care has been exercised in the aerodynamic design of this ventilator and particular attention paid to its weatherproof and cinderproof qualities; the device is, in fact, monsoonproof and snowproof.

The unit is constructed with a one-piece circular dome-shaped metal pressing or shell forming the main body and fixing flange; to the latter is attached a circular outer deflector plate which surrounds the shell up to approximately three-quarters its height, and is separated therefrom by a continuous air gap. Pierced in the outer deflector are six apertures varying in size and shape in the front and back of the main shell, screened by the outer deflector; two apertures are pierced and interconnected by an interior balance duct having an open top and inwardly curved sides and lips; the top of the duct is in direct communication via the two inside apertures on each side of the duct with the interior of the vehicle, and the fore and aft apertures in the main shell situated at the extremities of the ducts are protected by monsoon strips of a special shape as well as by the outer deflector.

Air extraction begins in the lightest of breezes blowing from any direction at approximately 1½ m.p.h. with the vehicle stationary, or in an air flow of a like speed set up by the movement of the vehicle. Air is drawn up on each side of the centrally disposed balance duct, over the curved lips thereof, down through the duct and shell apertures, underneath the monsoon strips, and finally ejected through the surrounding space or air gap between the deflector top and the shell, and via the side apertures in the deflector. At low speeds the top edge of the front deflector and the first-side aperture together create the

necessary ejector action, but as the speed increases the other apertures in the deflector sides come automatically into operation. At high speeds an area of negative pressure is set up simultaneously behind the front and rear deflectors, over the top of the shell, and outside the six side apertures.

The Nuvac ventilator is constructed of lead-coated sheet



The Nuvac ventilator

steel throughout. Its overall height is 3½ in.; the circular base is 9 in. diameter, drilled with six ¼-in. holes equally spaced, and its weight, without interior fitting, is 2 lb. 4 oz.

**FITTED WAGONS ON THE CONTINENT.**—There appeared in a recent issue of the *Bulletin de l'Union Internationale des Chemins de fer* a table showing the number of goods wagons for international traffic on the Continent which were fitted with continuous brake on January 1, 1934. The total was 757,536, of which the largest individual contribution was made by Germany with 584,100 vehicles. Of these, 12,744 were also capable of working over the broad-gauge Russian lines. (See THE RAILWAY GAZETTE, April 26 last, page 767.) On all the French railways together there were 500,238 fitted wagons and brake vans. Totals in the other countries shown as possessing such stock were as follow: Belgium 114,454, Denmark 2,767, Finland 14,293, Greece 1,758, and Spain 39,926.

## SIGNALLING ON THE BELGIAN NATIONAL RAILWAYS

### *An account of the principal features of the three-position signal system used in Belgium*

THE Belgian railway system, by reason of its important geographical position and consequent close connection with the railways of several countries, developed rapidly into a complicated network of lines carrying a heavy traffic, which in turn early necessitated the adoption of efficient signalling equipment. The first installations were modelled largely on British practice, much of the apparatus being supplied by Saxby and Farmer, with rod

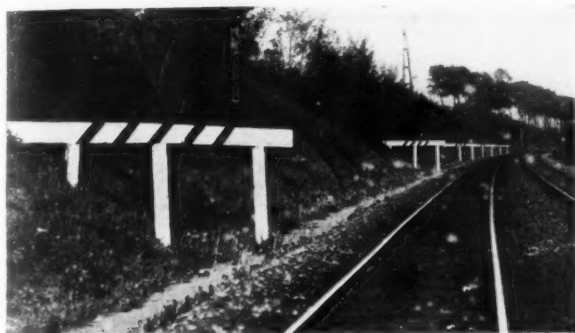


Fig. 1—Approach warning boards in front of a distant signal

operated points and lower quadrant signals worked by single wires. Both semaphores and discs were used, distant or, as it would be more correct to call them, outer signals, being square shaped discs at which trains were required to stop. On the Grand Central Belge Railway, a private line taken over by the State on January 1, 1897, the double-wire system was adopted, but the State lines did not make much use of it for points until about 1904, though they had already done so for signals to a certain extent in connection with the introduction of the Siemens & Halske lock-and-block apparatus.

The Hodgson lock-and-block system and the Flamache-Schubart system were at first used in some of the Saxby cabins. When double-wire working was adopted generally about 1907, the levers in those cabins were arranged to operate the new type of transmissions. Gradually, however, the drum pattern of lever, derived from German practice, was adopted for all new work. The principal steps in these developments were made under the direction of the late Monsieur L. P. A. Weissenbruch, who became Signal Superintendent in 1901 and was General Secretary of the International Railway Congress Association from 1897 until his death in 1921. On his advice, in connection with the introduction of faster services on the principal main line sections, a new system of signal aspects was introduced in 1907 on the Brussels-Antwerp and Brussels-Mons lines. Its chief features were the adoption of yellow painted distant signals with yellow lights for "caution," in place of the old outer signals; bracket home signals at junctions with bracket distant to correspond, and arms moving in the upper quadrant.

This system became the standard, being extended to cover all the main routes, totalling 1,600 km. (1,000 miles), and it remained so until after the war, when the reconstruction of a great deal of the signalling became neces-

sary. This was partly owing to damage, and partly because the German administration had substituted signals of its own type on many sections. To reduce the expense and accelerate the work it was determined to adopt the three-position principle, derived from American practice, enabling fewer signals to be used, especially at junctions. A new code of aspects was worked out, under Monsieur Weissenbruch's direction, and the necessary mechanisms were designed in collaboration with signal manufacturers.

On November 11, 1919, the three-position signalling was inaugurated between Brussels and Antwerp, and it is now in operation on 775 km. of double track (485 miles). The two-position system is therefore still in use to a large extent, and to prevent confusion between the old and new signals the former have had circular discs affixed to their arms as a distinguishing sign. Two interesting features of the old signalling require to be noticed. One is the use of approach warning boards, illustrated in Fig. 1, before all distant signals. These are still employed and are installed in front of all signals capable of displaying a "caution" indication. The other is the installation of luminous fog repeater signals, Fig. 2, on the Brussels-Antwerp line, brought into use on June 15, 1908. Each distant signal was preceded by three, and each stop signal by two such repeaters spaced 150 m. (164 yd.) apart. Their working was a great success, but they were removed during the war and never replaced. Cab signalling apparatus of the "crocodile" ramp pattern has, however, been installed in recent years, acting on the Flaman, Teloc or Hasler speed recorders on the engines, similar to the apparatus used on the French lines. The signalling on the Nord-Belge lines is, of course, of French pattern.

#### Principles of the Three-Position System

The principal characteristic of the Belgian three-position signalling is the use of both stop and distant type arms, each of which can be worked to three positions, and be used singly or in combination (Fig. 3). The stop pattern of arm is shaped and painted like the British type, but the distant arm is arrow headed, not fishtailed, the reason being that for some years the fishtail form was used in Belgium for quite another purpose. The yellow painting of distant signals has long been customary. The rules on which the use of these signals is based will be readily understood with the aid of a few typical examples.

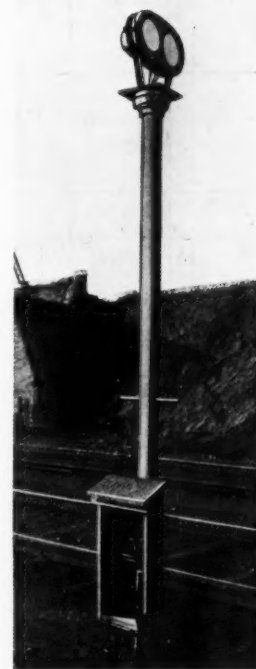


Fig. 2—A fog repeater installed on Brussels-Antwerp line in 1908

The simplest example is that of a single stop signal used, say, at an intermediate block post, as shown in Fig. 4, working to the "stop" and "proceed" positions (the positions which the arms can take up are shown in the diagrams by dotted lines). In that case a distant signal is installed, also working from 0 deg. to 90 deg. at a distance on level track of 800 m. (875 yd.) from the stop signal or 1,000 m. on lines where speed is more than 100 m.p.h. When two stop signals follow one another at from 800 m. to 1,000 m. (875 to 1,094 yd.) there is no separate distant signal for the second one. Instead of that the first one is worked to three positions and can be cleared no further than 45 deg. when the first one is at "stop." Fig. 5 shows this arrangement. The two signals may be worked from the same or different cabins. The various indications are arranged solely on the basis of distance, gradient and speed and, in interpreting them, the driver is not concerned with which signal cabin works the signals.

When the distance between two stop signals is less than 800 m. (875 yd.) and the "caution" (45 deg.) position of the first gives insufficient warning for the second, the distant signal assumes the 45 deg. position, as shown in Fig. 6, until the second stop signal is cleared. In this position, as shown in the diagram of signal aspects, Fig. 3, and called "attention," a green and a yellow light appear side by side (equivalent to double yellow in Great Britain).

When a stop signal is required at the point A, as in Fig. 7a, and there is less than 800 m. (875 yd.) between B and C, a distant arm is provided beneath it so that four indications may be given by the signal. When the



Fig. 4

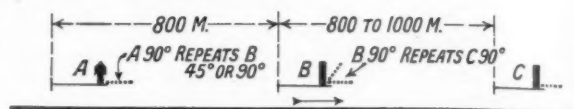


Fig. 5

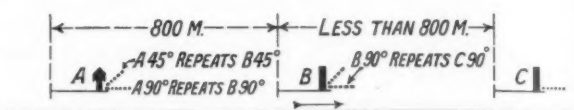


Fig. 6

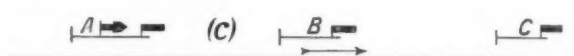
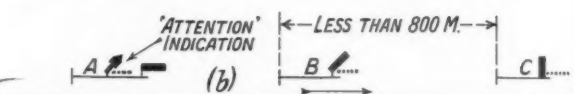
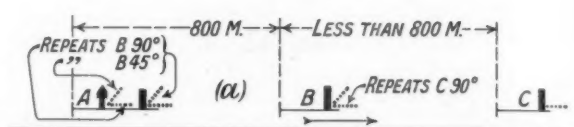


Fig. 7(a), 7(b) and 7(c)

Figs. 4-7—Applications of signals

top arm at A is at 45 deg. it indicates that B is "on," when at 90 deg. that B is "off," the distant arm beneath then showing whether reduced speed at B is required or not. The positions of the signals in the two last cases are given in Figs. 7b and 7c. If there is 800 m. (875 yd.) or more between B and C then, of course, a plain three-position stop signal at A suffices. These illustrations are sufficient to enable the use of the signals for all ordinary cases of straight running to be understood.

### Junction Signalling

The stop signals at junctions are still arranged on the bracket, or geographical, system, introduced when the upper quadrant two-position signalling was adopted, but there are no bracket distant signals in the three-position system. Instead, the junction distant signal has a single arm and is worked on the speed principle as shown in Figs. 8a, b, c. When a junction home signal is cleared for a route having a radius less than 500 m. (547 yd.), the distant signal assumes the "attention" position, warning the driver that reduced speed is necessary over the junction. When the stop signals are "on," the horizontal distant arm gives notice of the fact. This method of working has been found of great use in keeping traffic moving in foggy weather. A combined signal can be used at A in the figure when a stop indication is required there in addition to the three others, on the principles already explained; but if there is no restricted speed route at the junction, such stop signal is a plain three-position signal, as seen in Figs. 9a, b.

STOP SIGNALS			DISTANT SIGNALS		
ASPECT		MEANING	ASPECT		MEANING
DAY	NIGHT		DAY	NIGHT	
	RED LIGHT	STOP		YELLOW LIGHT	CAUTION: PREPARE TO STOP AT NEXT SIGNAL
	YELLOW LIGHT	CAUTION: PREPARE TO STOP AT NEXT SIGNAL		GREEN LIGHT BESIDE YELLOW LIGHT	ATTENTION: REDUCED SPEED AT NEXT SIGNAL
	GREEN LIGHT	PROCEED		GREEN LIGHT	PROCEED

COMBINED SIGNALS							
ASPECT	MEANING	ASPECT	MEANING	ASPECT	MEANING	ASPECT	MEANING
	STOP		CAUTION		ATTENTION		PROCEED

The lights exhibited in combined signals correspond exactly with those shown for the equivalent meanings in the single arm signals.

When colour light signals are used the "Caution" indication is conveyed by TWO yellow lights placed vertically to assist in eliminating any confusion between red and yellow in foggy weather.

Fig. 3—Three-position signal indications used on the Belgian National Railways

Where there is a group of lines in running into which the speed must not exceed 40 km.p.h. (25 m.p.h.), route indicators are used in conjunction with a single-armed signal. In that case the distant signal gives only the "caution" and "attention" indications.

#### Operation of Signals

Except where electric power signalling is in use, as mentioned below, the signals are operated mechanically by the double-wire system, and the various controls for producing the 45 deg. and 90 deg. positions of the semaphore are obtained, in the majority of cases, by the use of special slotting mechanism. In the example given in Fig. 8a, however, this is not necessary for the three-position distant signal, which is accordingly worked as shown in Fig. 10 by means of two levers in the signal cabin, the transmissions from which act on a cross-bar at the

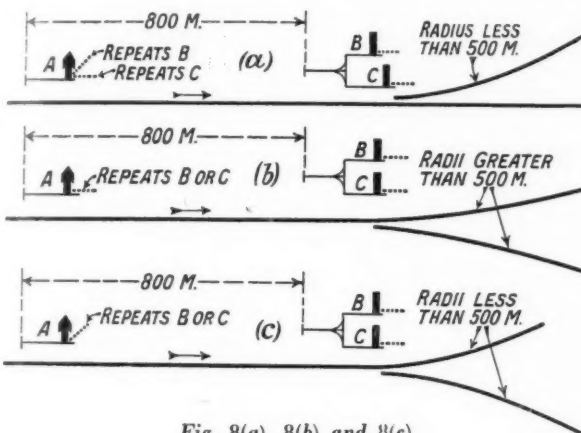


Fig. 8(a), 8(b) and 8(c)

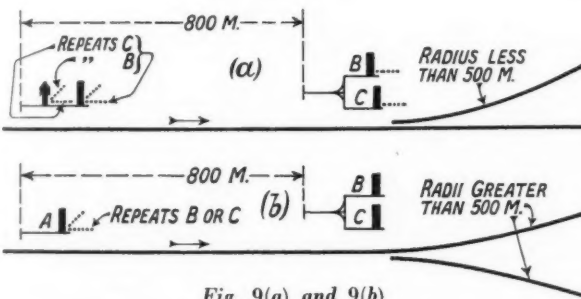


Fig. 9(a) and 9(b)

Figs. 8 and 9—Applications of signals

signal and impart the full stroke or half stroke to the arm. These levers are, of course, suitably interlocked with those working signals B and C.

The simplest example of the use of slotting is that shown in Fig. 5, where we may assume signals B and C to be worked from different signal cabins. When the lever working B is reversed, that signal must move only to the 45 deg. position, but when C is pulled off it must move automatically to 90 deg. when the C signalman pulls his distant lever. Should the lever working B be returned to normal, the arm must, whatever position it is in, move right back to "stop." Similarly, should signal C be returned to "stop" first, then the arm of B must move back, but only to 45 deg., without signalman B having to do anything.

There are several forms of slot apparatus in use, for fixing either in the runs of the wires or on the signal posts.

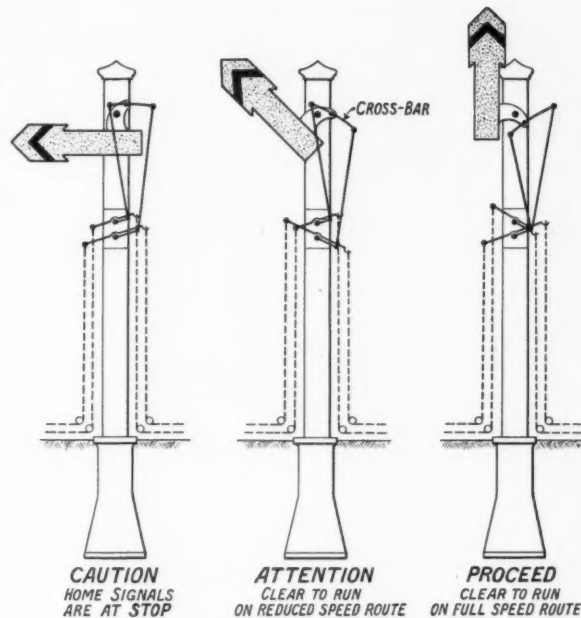


Fig. 10—Operation of three-position junction distant signal

The principles of one form, the César rotary apparatus, are illustrated in Fig. 11, and a view of one of the centrally balanced type arms with the slot mounted on the arm spindle is given in Fig. 12. The slide bars in Fig. 11 are in reality discs, and the swinger is a cross-bar attached to the arm spindle with rollers at each end, engaging with notches in the discs. By arranging slots to act in combination, supplemented at times by electric signal reversers, the various indications required can be produced according to circumstances.

As the double-wire system ensures that the necessary movement is always transmitted efficiently to the signal mechanism, there is no great difficulty in obtaining accurate signal aspects at all times. The transmissions are

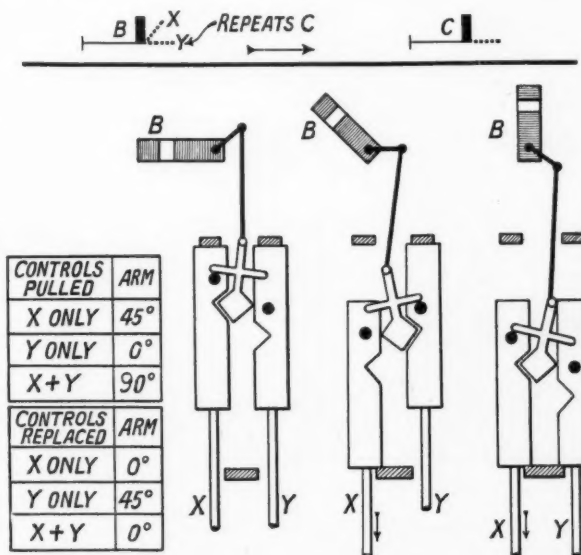


Fig. 11—Principle of operation of César rotary signal slot

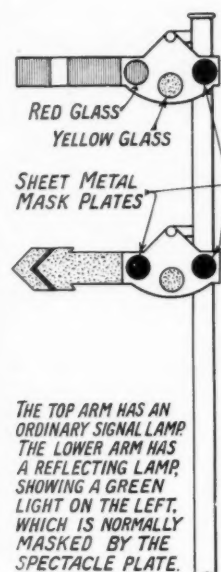


Fig. 12—Centrally-balanced three-position semaphore with rotary slot mechanism mounted on arm spindle (César's system)

formed of solid steel wire, 4 mm. ( $\frac{3}{16}$  in.) dia. for signals and 5 mm. ( $\frac{1}{4}$  in.) dia. for points. A small, light but strong chain is used at wheels and lever drums, and not wire rope. The tension is regulated about twice yearly and compensators are used, as a rule, only on long transmissions.

#### Night Indications

The colours of these are given in Fig. 3. The various changes are produced by spectacles, the working of which



THE TOP ARM HAS AN ORDINARY SIGNAL LAMP. THE LOWER ARM HAS A REFLECTING LAMP, SHOWING A GREEN LIGHT ON THE LEFT, WHICH IS NORMALLY MASKED BY THE SPECTACLE PLATE.

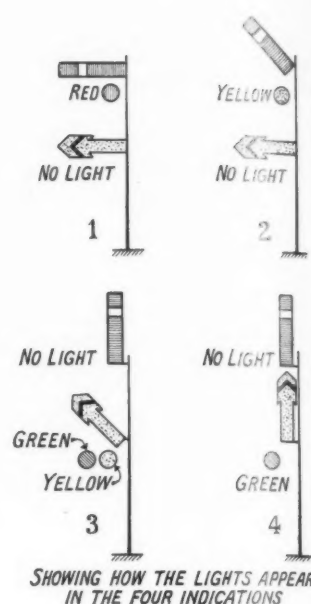


Fig. 13—Latest pattern of two-armed signal showing how the night signals are produced

is of some interest in the case of combined stop and distant signals. In the earlier pattern of two-armed signal there was a reflecting lantern provided for the top arm, which can be seen on the signal on the right of Fig. 14; the lower arm was without a lantern. This lantern produced a direct white light, in front of which moved the spectacle of the top arm, carrying red and yellow glasses, and a reflected green light, before which moved a sheet metal mask, or blinder, driven from the lower arm. In the 1931 type of signal, seen in Fig. 15, there is a lantern for

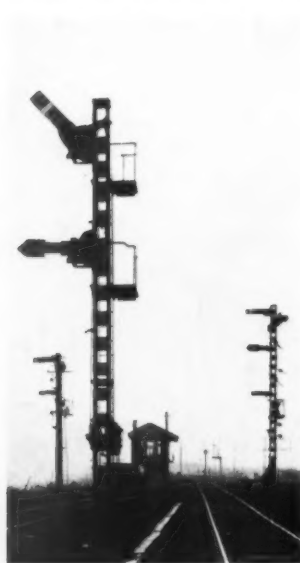


Fig. 14



Fig. 15



Fig. 16

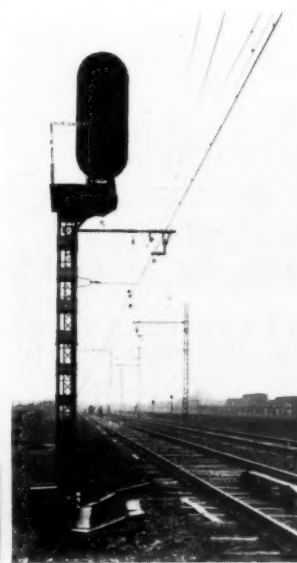


Fig. 17



Fig. 18

Fig. 14—Three-position semaphore signals, showing "caution" indication; earlier form of two-armed signal on the right, with centrally-balanced arms. Fig. 15—Two-armed signal in the "Attention" position, ordering reduced speed at the following signal. The lights are as shown in the diagram Fig. 13; the lanterns are not in place in this picture. Fig. 16—Three-position distant signal in the "proceed" position. Fig. 17—Colour light signal on Brussels-Antwerp line, with cab-signalling ramp. Fig. 18—Bracket-type colour-light signal, showing telephone box for communicating with signal cabin

each arm, the lower being of the reflecting type. The top arm shows a red or yellow light for 0 deg. and 45 deg., the lower arm then showing no light. When the top arm goes to 90 deg. its light is obscured and the lower arm then shows green and yellow (45 deg.) or green (90 deg.), as shown on the diagram, Fig. 13.

#### Block System and Power Signalling

There are no automatic block signals on the Belgian National lines. The most important sections, totalling 1,021 km. (638 miles) are worked by means of the Siemens and Halske lock-and-block system with rail-contact control, the line being normally blocked. The remainder is worked by telephone.

Colour-light signals have been introduced on the electric lines between Brussels and Antwerp and between Namur and Charleroi, over a distance of 81 km. (50 m.), but they are worked from cabins in the same manner as the other signals. In some cases, as seen in Fig. 19, a small power frame controls the light signals, forming an electro-mechanical arrangement.

Power signalling has been widely adopted, exclusively of the all-electric type. The first installation, on the Siemens and Halske system, was put into service at Antwerp Central in 1904, and many other cabins of the same type, but incorporating improvements from time to time, were constructed at the principal stations in the years preceding the war. In 1905 the large cabin at Brussels Nord, then among the biggest in Europe, was

opened, and it continued to work until early in the present year, when it was replaced by one constructed by the Ateliers de Constructions Electriques, of Charleroi, which has supplied many electrical frames of recent years. The new cabin is illustrated in Fig. 20 and controls the whole of the extensive terminus lines with their approach routes. The train service is a heavy one and there is a great deal of shunting.

Belgium early adopted shunting signals instead of point indicators, following English principles, and in Fig. 14 shunt arms are seen. They show a violet light for "stop." A yellow light (45 deg.) means that shunting is authorised up to a limiting signal or an obstruction, a green light (90 deg.) authorises an unlimited shunt, or allows a train to take siding at intermediate stations.

#### Train Despatching

Before the war the management of the Belgian railways had come to the conclusion that some form of train despatching, or traffic control, was necessary to overcome certain difficulties in train working which occurred from time to time. Just before war broke out it had been decided to adopt the methods then in use on the Prussian State Railways, and the necessary apparatus was actually on order. After the war, as a result of the experience obtained in France with American selective telephone equipment, the Belgian administration reviewed the question once more and decided to instal the same apparatus on the heavily worked section between Brussels and Namur, where it was brought

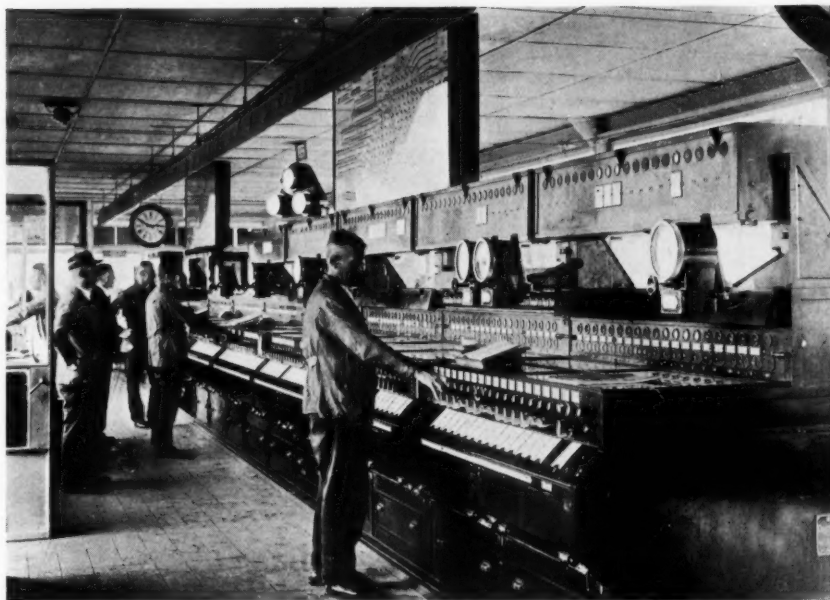


Fig. 20—Interior of new electric power signal cabin at Brussels Nord, A.C.E.C. system

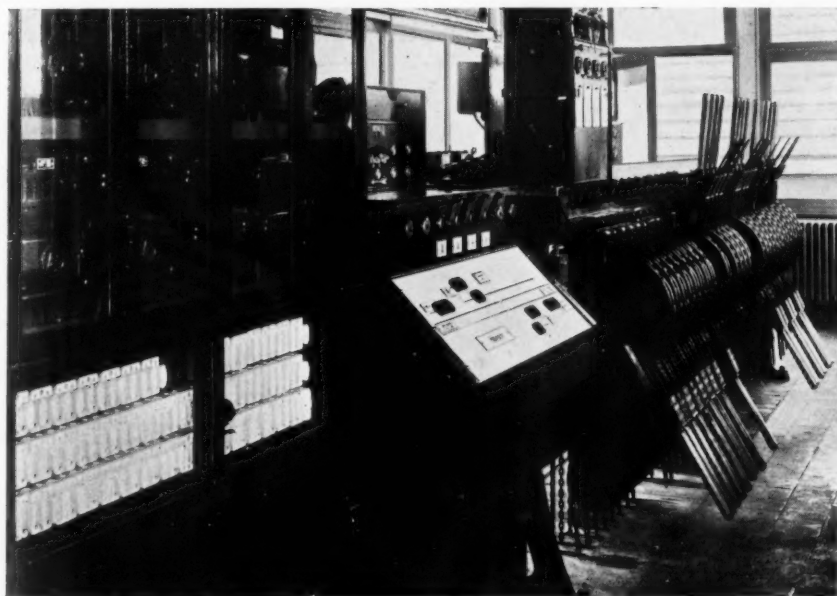


Fig. 19—Interior of signal cabin showing double-wire mechanical frame, electric subsidiary frame controlling light signals, and lock and block apparatus



Fig. 21—Interior of train dispatcher's office at Brussels Nord

into use on October 1, 1921. The results exceeded all expectations, and the savings realised by smoother train working and better use of rolling stock and trainmen's

to protect the large traffic carried on their system, and the results form an excellent tribute to the late Monsieur Weissenbruch, his capable successors and their assistants.

time led to the extension of despatching on all the main routes, so that today a total length of 2,207 km. (1,380 miles) is equipped. The numerous junctions, loops and spur lines, which abound in Belgium, make the working of the traffic a matter of no little difficulty at all times, and the despatching system has had every opportunity of proving its value. According to Monsieur De Caestecker, then Chief Despatcher at Brussels Nord, writing only three years after the system was introduced, an annual saving of over fr. 27,500 per km. had been obtained and there were probably other savings that could not be directly ascertained.

It will be evident from the foregoing that the Belgian railways rank among the most progressive in the world in the adoption of sound signalling and operating methods. They have for years spared no effort to provide every reasonable safeguard

## NEW STEAM RAILCAR LOCOMOTIVES, AUSTRIAN FEDERAL RAILWAYS

*A luggage compartment is built on to the frames of these new 2-4-2 type light traffic engines*

FOR some years past light passenger trains on the Austrian Federal Railways, consisting of from two to five four-wheeled coaches, have been worked by 2-6-2 non-superheated compound locomotives. These, however, have proved too large and heavy for the class of service, causing uneconomical operating results, and the endeavour has therefore been made to replace them by other units possessing sufficient tractive effort and speed to meet all the requirements of quick suburban service with light passenger trains of the character above referred to, having due regard to economical working. It was, moreover, desired that the new unit should be able to haul light fast trains over long distances, and it was finally decided

to build a railcar type of locomotive consisting of a 2-4-2 steam engine having a built-in luggage compartment on the same framing. This new type of eight-wheeled vehicle was constructed by the Austrian Federal Railways in collaboration with the Wiener Lokomotiv-Fabriks A.G., Wien-Floridsdorf.

The new type, which is illustrated herewith, has a maximum speed of 62.1 m.p.h. and is designed for running at high speed on lines with light permanent way. The weight in working order is 42 tons, distributed with a load of 13 tons on each of the two driving axles and 8 tons each on the leading and trailing axles. When running on lines of light construction the axle load of the driv-



ing axles can be reduced to 11 tons by slackening off the bearing springs, whilst that on the other axles is increased to 10 tons.

In the construction of the locomotive a boiler of the standard type is used. This is fitted with a welded copper firebox, and Hanomag stays are used between the inner and outer firebox plates. The barrel is built up of a single ring with its longitudinal seam made as a double butt-riveted joint. The safety valves, which are of the pop type 2 in. in diameter, are fitted in the dome. As a relatively high boiler pressure is used and the weight of the locomotive is limited, the boiler is built of special steel plates.

The smokebox is equipped with an arrangement for removing ashes through a small cleaning door without its being necessary to open the main smokebox door. This prevents the ingress of cold air to the smokebox and tube plate, and avoids the risk of tube leakage.

Steam distribution is effected by poppet valves connected by Heusinger valve motion. The framing of the engine is built up of plate iron and angle frames, welding being employed to a large extent. All axles are equipped with inside axleboxes of the Friedmann type.

The cab is completely enclosed, and owing to the fact that the locomotive must be capable of operation by one man, a number of regulations, laid down by the Ministry of Commerce and Traffic, had to be observed. The regulator, reversing gear, and brake handles had to be so arranged that they could be operated from either side of the footplate whilst, furthermore, the guard, who rides on the fireman's side of the footplate, must also be able to bring the engine alone or with a train attached, to a standstill, and to meet these requirements an auxiliary apparatus had to be fitted. This comprises a valve for destroying the vacuum in the main pipe, which controls another steam operated valve allowing steam to enter a small cylinder, the piston of which automatically closes the regulator. Similarly both oil and coal firing are arranged for, the first for one-man operation and the second when two men are employed. Two oil burners on the Hardy system are fitted inside the firehole door of the firebox; the oil burners are fed with crude oil. The fittings of the oil-firing apparatus are arranged so that

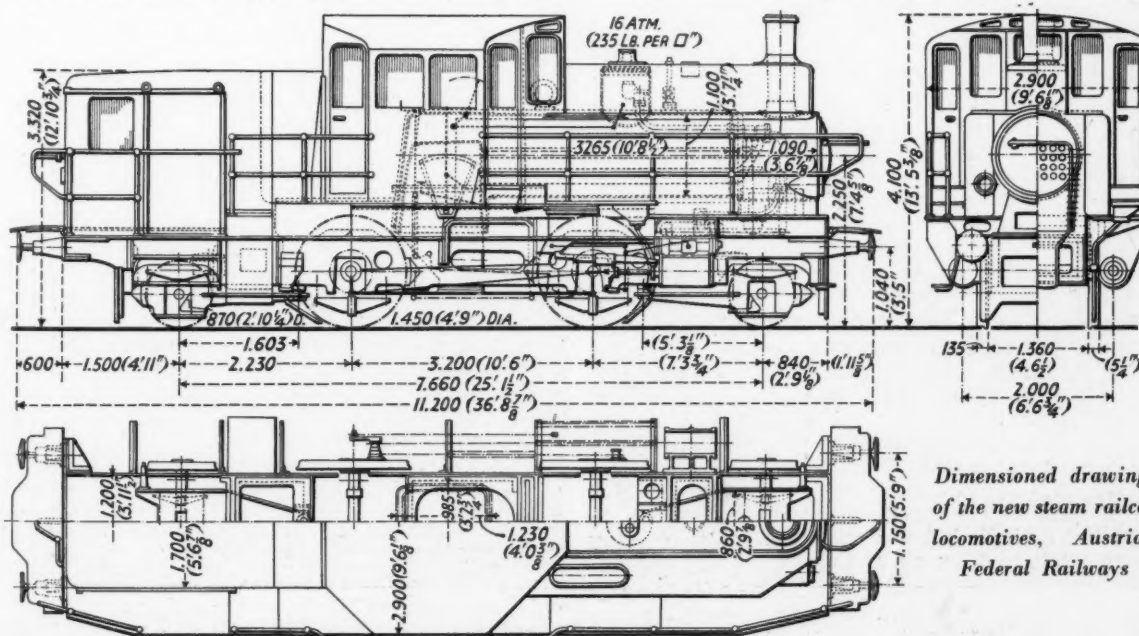
they can be easily operated by the driver, and when the regulator is closed the burners are automatically brought into the small feed position. The roof and inside walls of the cab are lined with wood and four doors lead to the platforms, making it possible to pass through the railcar to the attached coaches without danger. The Hardy vacuum quick-acting automatic brake is used on all wheels, and a hand brake on the coupled wheels also.

The locomotive is equipped with a feed-water heater of the Heintz pattern and is built for an average capacity of 4 cu. m. of feed-water an hour. A non-lifting injector of the Friedmann system is provided. Other equipment includes Friedmann mechanical lubricators for cylinders, valves and axle bearings, and a Sunbeam turbo-dynamo for lighting purposes, including electrical current for the lamps in the cab and luggage compartment, two head lights at each end of the railcar, and a searchlight fitted vertically at the top of the boiler. The last named fitting is to render the railcar visible over long distances at night time.

The following are the main particulars additional to those shown on the drawing reproduced below :—

Cylinders (2), dia. . . . .	290 mm. (11½ in.)
Piston stroke . . . . .	570 mm. (22½ in.)
Heating surface—	
Tubes . . . . .	38.03 sq. m. (410 sq. ft.)
Firebox . . . . .	4.45 sq. m. (48 sq. ft.)
Total . . . . .	42.48 sq. m. (458 sq. ft.)
Superheater . . . . .	16.47 sq. m. (173.4 sq. ft.)
Grate area . . . . .	0.83 sq. m. (9 sq. ft.)
Capacity of water tanks . . .	4.7 cu. m. (1,034 galls.)
„ coal bunker . . . . .	1.1 t. (1.08 tons)
„ oil tank . . . . .	1.17 t. (1.15 tons)
Luggage compartment, area . .	4.4 sq. m. (47.3 sq. ft.)
Weight, empty . . . . .	34.2 t. (33.5 tons)
in working order . . . . .	42 t. (41.2 tons)
Maximum speed . . . . .	100 km. per h. (62.1 m.p.h.)

These locomotives, or, as they are termed, steam railcars, have been placed in service only recently, after undergoing very severe tests on lines with many sharp curves and light track, when a thorough study of their running was made. The tests proved that they were capable of running at high speeds, reaching on the level 116 km.p.h., whilst smoothly passing through curves having a radius of only 200 m. at a speed of 70 km.p.h.



Dimensioned drawings  
of the new steam railcar  
locomotives, Austrian  
Federal Railways

### Petrol Driven Permanent Way Maintenance Tools

*Views of applications of the "John Bull" petrol engine for drilling and cutting rails and for boring holes in sleepers. This two-cylinder two-stroke engine gives an output of nearly 4 h.p. at 3,500 r.p.m. By gearing, the drill spindle speed is reduced to 300-350 r.p.m. The two flexible tubes are the silencers*

*(See editorial note on page 1147)*



*"John Bull" rail saw*



*"John Bull" sleeper borer*



*"John Bull" rail drill*

## NEW STREAMLINED TRAINS, BALTIMORE AND OHIO RAILROAD

*These lightweight trains de luxe, the one built of steel and the other of aluminium, are being specially introduced for high-speed service. The first of them will run from Chicago to St. Louis and back daily*

ON page 201 of our issue of February 1 last and on page 738 of that dated April 19, we illustrated and gave particulars of the new 4-4-4 and 4-6-4 type high-speed express locomotives introduced by the Baltimore and Ohio Railroad for hauling new and luxurious lightweight passenger trains at high average speeds between Chicago and St. Louis, and probably on other sections of line as well. Two trains are being constructed

operating them as six, seven, or eight car trains as may be required.

The steel train weighs 40 per cent. and the aluminium alloy train 46·5 per cent. less than an equivalent train made up of conventional steel passenger vehicles. All the cars are equipped with Duryea cushioned underframes, a form of construction which permits the centre sills to move 4 in. in either direction from normal, through the body of



Combination dining and lunch car showing (left) the dining room, and (right) the cafeteria

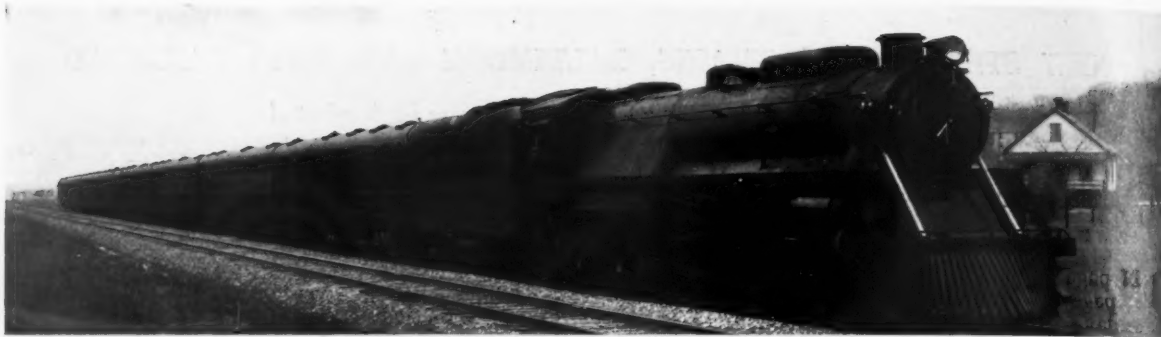
and the first one, built of steel, has now been completed. It has been named the Abraham Lincoln and as from July 1\* will make the run of 285 miles each way between Chicago and St. Louis in approximately five hours, leaving St. Louis in the morning and returning in the afternoon. The second train, built of aluminium, will be delivered at an early date, but the service to which this will be assigned has not yet been announced.

The two trains are of similar construction and each is made up of five types of vehicles in the following order:—Postal and luggage van, three reclining-seat cars, one combination dining and lunch car, two chair cars, and one observation car, also equipped with seats of the armchair type. The length of each eight-car train is 557 ft. 10 in. and seating capacity is provided for 283 passengers exclusive of the dining and lunch car, which provides seats for 42 persons. The non-articulated construction of these trains makes it possible to cut out one or more cars, thus

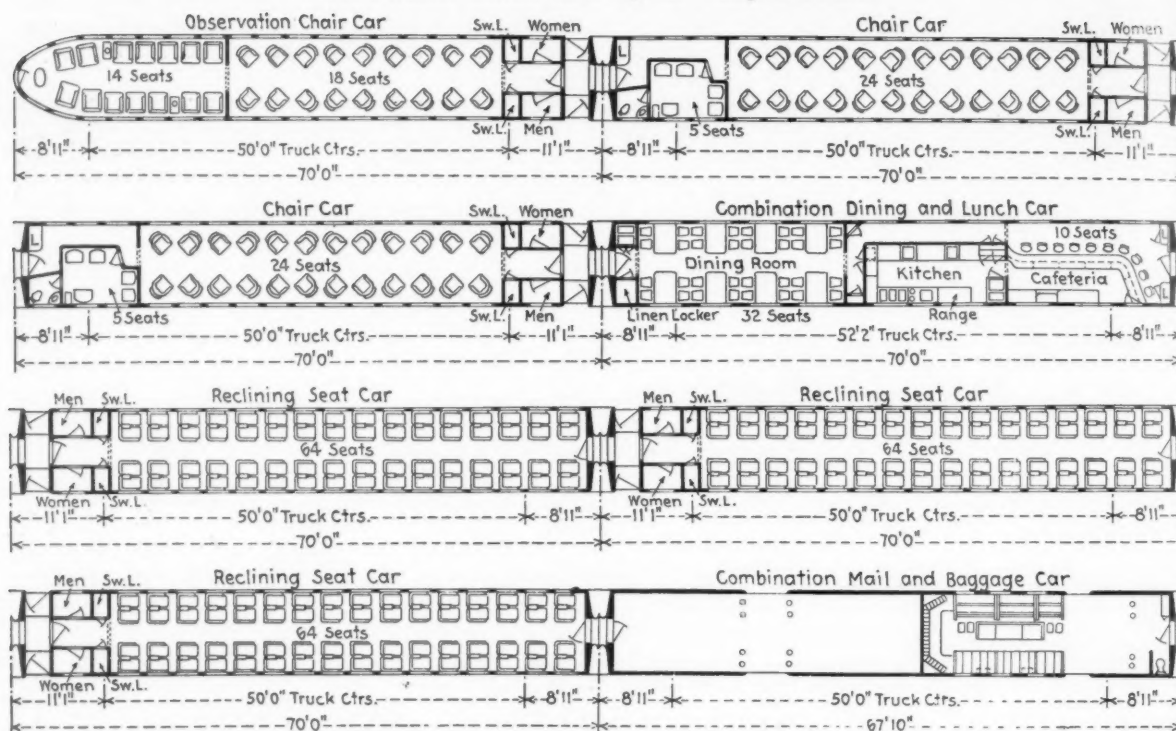
the car. The sill is anchored to the bolster centre filler castings through which it passes, by springs, links and pins, the spring gearing instantly cushioning the movement if the body moves or changes its relation to the centre sill. Thus the superstructure of the vehicle is allowed to float upon the underframe, which takes up the stresses of the car and gives absolute freedom from shocks.

A notable feature of the construction is the use of the Tomlinson tight-lock coupler, which carries the steam pipes, air hose and signal cords in a container, thus avoiding the necessity for men going in between the coaches to connect up these fittings. The couplers when in the coupled position are tightly locked against vertical, lateral or longitudinal movement between the coupler faces, all slack or lost motion being eliminated. This contributes to smooth handling of the train and also prevents telescoping in case of derailment. The coaches of both trains are equipped with air-conditioning apparatus, using the B. & O. standard system by means of which humidity conditions are kept within desired limits, both when cooling or heating the cars. The lighting and decorative effects in the vehicles are designed to produce the most

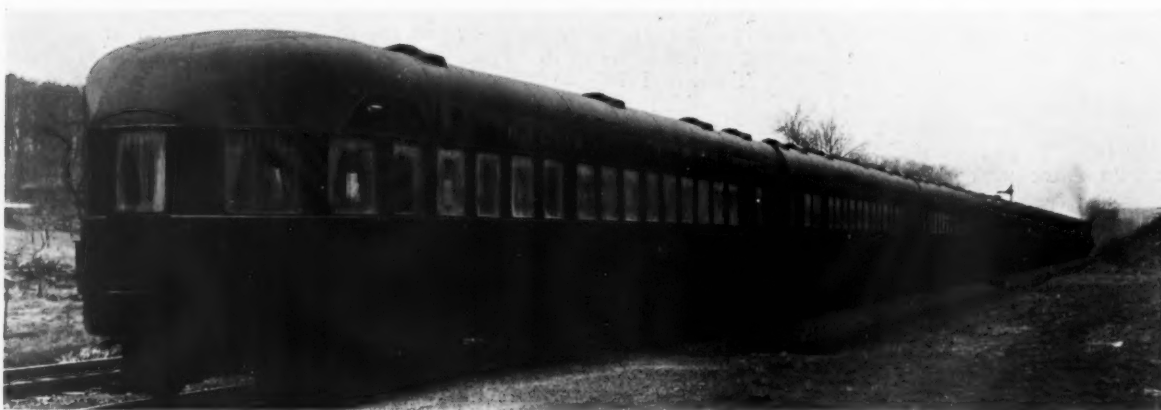
\* On page 1079 of our issue of May 31 we stated that it was intended to introduce the Abraham Lincoln service on June 1. We are now officially informed that July 1 is the inauguration date.



*The Abraham Lincoln hauled by the "Lady Baltimore"*



*Standard make-up of the Abraham Lincoln streamlined train, Baltimore and Ohio Railroad  
(Reproduced from our American contemporary the "Railway Mechanical Engineer")*



*View of train from the rear, showing the streamlined end of the observation chair car*



*Observation chair car with movable seats*



*Smoking car on the Abraham Lincoln*

strikingly harmonious effects. The chairs in the observation car, it may be noted, are equipped with Dunlopillow rubber-cushion seats. The vehicles are carried upon lightweight four-wheeled bogie trucks, fitted with Timken roller bearings in the steel train and Hyatt roller bearings on the aluminium alloy train. Practically the same structural design is used in both of the trains, except that certain aluminium alloy members are increased in cross-sectional area in order to keep deflection within required limits, whilst certain changes are necessary in the rivet spacing.

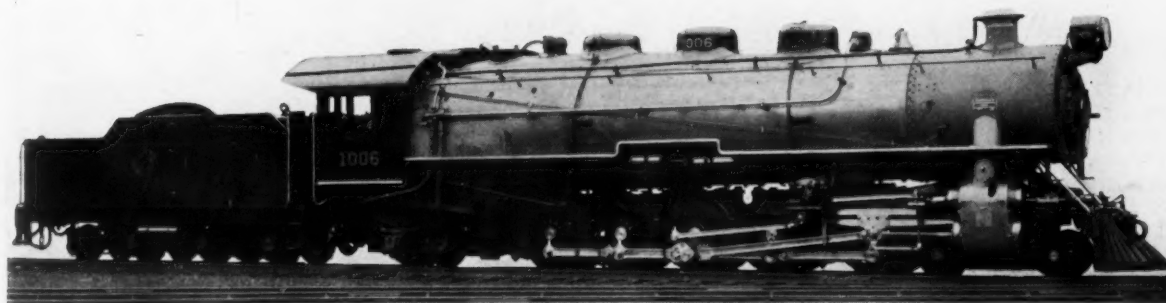
The underframes of the steel cars are built up of steel having a yield point of 50,000 to 60,000 lb. per sq. in., and improved rust-resisting qualities. The lightweight steel castings employed are of manganese-chrome-molybdenum steel. The roof construction utilises 13-gauge pressed-channel carlines, and pressed Z-purlines connected by welding, the roof plating being riveted and welded. The floor construction is comprised of 16-gauge aluminium floor plates installed cross-wise and riveted to the floor sup-

ports. Cork insulation is applied and a material known as masonite-tempered "Presdwood" cemented over the entire floor.

In the aluminium alloy cars the underframe, with the exception of the centre sill, is built up of strong aluminium alloy extruded shapes and formed plates; the side sills consist of extruded shapes designed to give the necessary cross-section and permit easy assembling. The sides consist of extra wide plating of strong aluminium alloy, stretcher-levelled so as to make one smooth and uniform surface from the eaves to the skirt of the car, the plates being joined together with the edges butted on the large side posts, the joint coming directly over the small groove in the centre of the posts. Electric arc welds are run from end to end of this joint.

The layout and assembly of the vehicles comprising these "all-blue" trains can be gathered from the plan drawing appearing on page 1168, whilst the illustrations, for the originals of which we are indebted to the Baltimore & Ohio Railroad, further assist in illustrating the trains.

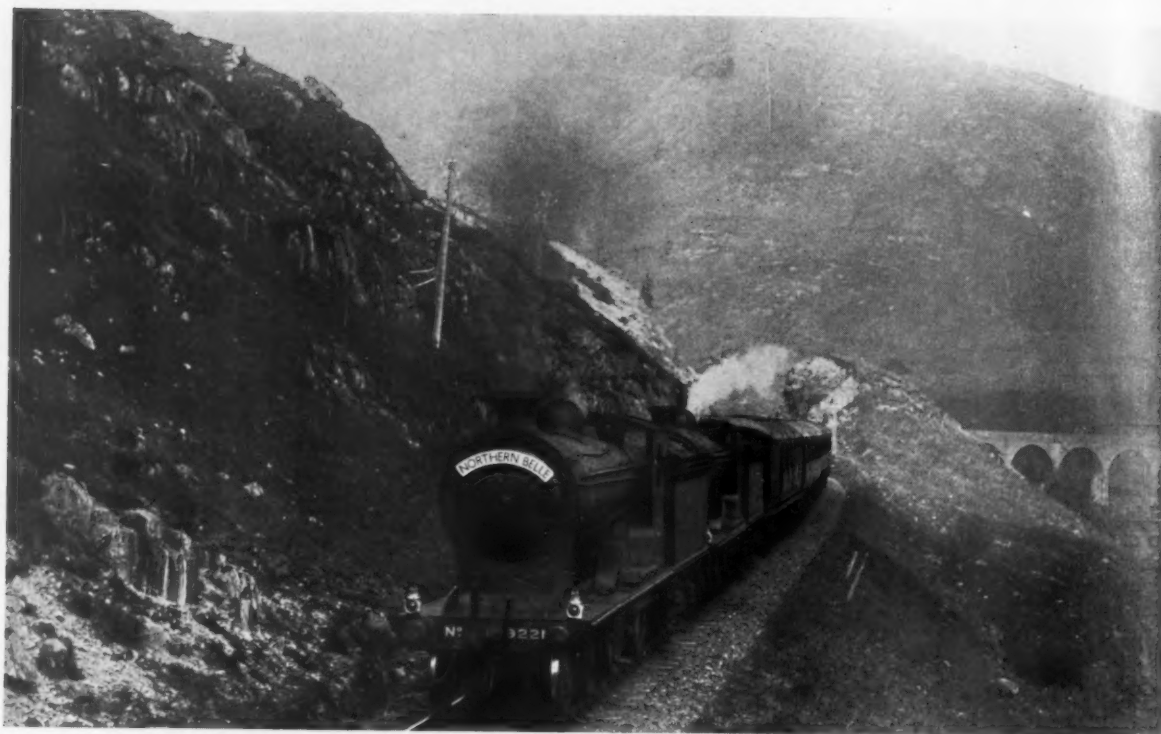
### A Large Metre-Gauge Locomotive for Brazil



New 3-cylinder 4-10-2 locomotive just delivered to the metre-gauge Sorocabana Railway by the American Locomotive Company. Leading dimensions are: cylinders 18½ in. dia. by 24 in. stroke (22 in. inside cylinder); driving wheels 4 ft. dia.; boiler pressure, 210 lb. per sq. in.; evaporative heating surface 3,261 sq. ft.; superheating surface 857 sq. ft.; grate area 55.5 sq. ft.; weight in working order, engine 105 tons, tender 42 tons

## The Northern Belle Cruising Train

(See article on page 1175)



*The cruising train in the Western Highlands*



*The Northern Belle cruise party at Grantown-on-Spey*

# RAILWAY NEWS SECTION

## PERSONAL

### BRITISH CABINET CHANGES

As a result of the resignation of Mr. Ramsay MacDonald from the office of Prime Minister and First Lord of the Treasury on June 7, Mr. Baldwin accepted the King's invitation to fill the position, and the consequent changes in the Cabinet that most closely concern railways are as follows:—

Sir John Simon becomes Secretary of State for Home Affairs (in place of Sir John Gilmour) and Deputy Leader of the House of Commons.

Sir Samuel Hoare, previously Secretary of State for India, becomes Secretary of State for Foreign Affairs (instead of Sir John Simon.)

Sir Philip Cunliffe Lister, formerly Secretary of State for the Colonies, becomes Secretary of State for Air (in place of the Marquess of Londonderry).

The Marquess of Zetland becomes Secretary of State for India (in place of Sir Samuel Hoare).

Mr. Malcolm MacDonald becomes Secretary of State for the Colonies (instead of Sir Philip Cunliffe Lister).

Mr. Ernest Brown becomes Minister of Labour in place of Mr. Oliver Stanley.

The following remain in their old offices: Mr. Neville Chamberlain, Chancellor of the Exchequer; Mr. J. H. Thomas, Secretary of State for the Dominions; and Mr. Walter Runciman, President of the Board of Trade.

Sir Kingsley Wood becomes Minister of Health and is succeeded as Postmaster General by Major G. C. Tryon, formerly Minister of Pensions, who has, however, no seat in the Cabinet.

### KING'S BIRTHDAY HONOURS (Additional)

#### O.B.E. (Military Division)

Lieut.-Colonel Raymond Carpmal, M.Inst.C.E., M.I.Mech.E., Engineer and Railway Staff Corps, Royal Engineers, Territorial Army. Colonel Carpmal is Chief Engineer, G.W.R.

From the *London Gazette* of June 7: Regular Army Supplementary Reserve of Officers; Royal Engineers; Transportation; Major S. E. Tyrwhitt having attained the age for removal, ceases to belong to the Reserve. May 14, 1935. Major Tyrwhitt is Assistant Divisional Locomotive Superintendent, Newport, G.W.R.

Mr. Ernest Edward Painter who, as announced in last week's issue of *THE RAILWAY GAZETTE*, has been appointed Secretary to the Railway Clearing House in succession to the late Mr. P. H. Price, was educated at the North London Collegiate School. He entered the Clearing House service on August 12, 1890, and was attached to the personal staff of the head of the Mileage Department, the late Mr. Henry Oliver (one of the four original Members of the Clearing House Staff

capacity he was responsible for the staff performing the secretarial duties connected with the many meetings of railway officers held at the Clearing House, and also the administration of the establishment, staff matters, &c., and the maintenance of the extensive premises. In 1925 the Mileage Department, dealing with the mileage and demurrage charges on rolling stock, and the common user of wagons, was merged in the Secretarial Department and placed under Mr. Painter's control.

Upon the formation of the various Railway and Traders' Conferences in 1924, Mr. Painter was appointed Secretary to the Railway Panel for the London and the Kent, Surrey and Sussex Areas. He is a Member of the Institute of Transport and represented the Railway Clearing House at the International Railway Congress Association Meetings in Rome (1922), London (1925), and Madrid (1930).

Mr. C. B. O. Clarke, Chairman of the Barranquilla Railway & Pier and of the Manila Railroad, who was also a Director of the Powell Duffryn Steam Coal and other colliery companies—whose death we announced in our issue of April 5—left estate valued at £749,317 (£738,537 net).

The funeral of Mr. E. Moore, sometime Chief Solicitor, Great Eastern Railway, whose death we recorded in our issue of June 7, took place at St. Paul's Church, Onslow Square, on June 6. Apart from family mourners there were among the congregation:—

Sir William Forbes, formerly General Manager, L.B.S.C.R.; Mr. H. T. Bailey, lately Director, G.E.R.; Sir H. Dalrymple Hay, Consulting Engineer, L.P.T.B.; Sir Charles L. Morgan, Director, S.R.; and Mr. E. C. Fordham (representing Mr. G. F. Thurston, Divisional General Manager, L.N.E.R.).

Mr. D. N. Dunlop, O.B.E., whose death was announced in *THE RAILWAY GAZETTE* of June 7, was born in 1868 and served his apprenticeship with the Howe Machine Company of Ardrossan. He subsequently went to the United States to join the American Westinghouse Electrical Company, and after experience there, returned to this country in the employ of that firm. In 1899 he was appointed its Assistant European Publicity Manager, and in 1902, was promoted to be Publicity Manager. On the formation of the British Westinghouse concern, he was appointed Sales as well as Publicity Manager. In 1911, Mr. Dunlop re-



Mr. Ernest Edward Painter,  
Appointed Secretary, Railway Clearing House

on its formation in 1842). Four years later Mr. Painter was transferred to the Secretarial Department and became confidential clerk to the then Secretary, Mr. Harry Smart, and also served his son, Mr. Harry Cuff Smart, in a similar capacity. He was appointed Secretary to the Metropolitan Conference of Railway Companies in July, 1911, to the Imported Goods Examination in February, 1916, and to the Continental Through Rates Conference in April, 1921; the two last-named were afterwards merged as the Continental Traffic Conference. In January, 1920, Mr. Painter became Head of the Secretarial Department and Principal Assistant to the Secretary. In this

signed from the firm in order to found the British Electrical & Allied Manufacturers' Association (B.E.A.M.A.), of which he was the first organising Secretary and subsequently a Director until his death. He also took an active part in the formation of the Electrical Research and Electrical

of a large congregation representative of his many interests. Mr. Dunlop's remarkable career is also referred to in an editorial note on page 1145.

Mr. D. McDougall, M.B.E., whose sudden death was recorded in our last week's issue, joined the North British

until July, 1921, and was awarded the M.B.E. for his good work there. On return to railway service, Mr. McDougall was appointed Chief Traffic Canvasser, N.B.R., and on the amalgamation, in 1923, continued in the same capacity under the L.N.E.R., for the Southern Scottish Area. In June,



**The late Mr. D. N. Dunlop, O.B.E.,**  
Founder and Director of B.E.A.M.A., and founder of  
the World Power Conference



**Mr. S. F. A. Morris, J.P.,**  
Divisional Superintendent, Gloucester, G.W.R.,  
1922-35



**Mr. O. E. Kinsman,**  
Appointed Assistant Divisional Superintendent of  
Operation (Motive Power), Derby, L.M.S.R.



**The late Mr. D. McDougall, M.B.E.,**  
Cartage Manager, Southern Scottish Area, L.N.E.R.,  
1929-35



*[Lafayette]* **Mr. H. Rudgard,** *[Manchester]*  
Appointed Assistant Divisional Superintendent of  
Operation, Derby, L.M.S.R.



**Mr. D. J. Harris,**  
Appointed Superintendent Marine Engineer,  
Euston, L.M.S.R.

Development Associations and was recently elected independent Chairman of the Electrical Fair Trading Council. Mr. Dunlop was even better known as founder of the World Power Conference, of which he was also Chairman of the International Executive Council and of the British National Committee until his death. He was awarded the O.B.E. for his many public services. The funeral took place at Golder's Green Crematorium on June 3, in the presence

Railway at Queen Street goods station, Glasgow in 1895 and three years later was transferred to the Goods Manager's office. After experience in the claims and goods rates sections, he was appointed District Traffic Canvasser in 1906, and, a few years later, General Enquiry Clerk to the Goods Manager. In 1917 he was loaned by the company to the Ministry of Food and was appointed Transport and Storage Officer for Scotland. He continued in the service of the Ministry

1929, however, he was appointed Cartage Manager of that area, the post he held until his death.

Mr. S. F. A. Morris, J.P., who, as announced in our issue of June 7, is retiring from the position of Divisional Superintendent, Gloucester, G.W.R., was born and educated at Chester. In 1891 he joined the G.W.R. at that station, but in the following year was transferred to the Divisional Superintendent's office at Paddington, where

he remained until 1901, with the exception of about a year (1895-6) in the General Manager's office. From 1901 to 1904 he served on the relief staff of the Divisional Superintendent's office, and thereafter was in charge of the new works, accidents and block telegraph section of that office. In 1907 Mr. Morris was appointed Chief Clerk of the Paddington Division, and was promoted to be Assistant Divisional Superintendent there four years later. He was transferred to Plymouth in the same capacity in 1913, and in 1917 became Divisional Superintendent at Westbury. It was in January, 1922, that he took over charge of the Gloucester Division. Mr. Morris is a Justice of the Peace for the City of Gloucester, a Trustee of the City Charities, and for 13 years has been President of the Gloucester G.W.R. Ambulance Corps. While at Plymouth during the war, Mr. Morris was closely associated with the organisation of Keyham Dockyard, and with work connected with liners calling at Falmouth and troop movements.

Mr. H. Rudgard, A.M.I.Mech.E., M.I.Loco.E., M.Inst.T., who, as announced in THE RAILWAY GAZETTE of June 7, has been appointed Assistant Divisional Superintendent of Operation, Derby, entered the service of the former Midland Railway in 1900, as a pupil under the late Mr. S. W. Johnson. After going through the various workshops he obtained six months' firing experience before entering the drawing office, and was later appointed to be District Locomotive Superintendent at Skipton, at Derby, and at Plaistow (London Tilbury & Southend Section). Mr. Rudgard was called up in the Territorial Army in 1914, and served for 20 months in the trenches, being later attached to the Royal Engineers, Light Railway Section, as Superintendent of the Light Railways, 4th Army, afterwards commanding the Light Railway Workshops, Beauriville, B.E.F., and Carriage and Wagon Depot, Audricq, B.E.F. He retired from the Army with the rank of Lieut.-Colonel. During service in France and Belgium he was twice wounded, and on two occasions was mentioned in despatches. In 1919 Mr. Rudgard was appointed Assistant Superintendent of Freight Trains, Midland Railway, Derby, and on the grouping of the companies was appointed Assistant to the Motive Power Superintendent, L.M.S.R., Derby. It was in February, 1932, that he became Divisional Superintendent of Motive Power (Midland Division), Derby, the position from which he has now been appointed Assistant Divisional Superintendent of Operation. In 1919 Mr. Rudgard was appointed to serve on a committee at the War Office to deal with the formation of the Supplementary Army Reserve, and in 1926 received a commission in the Land Forces as Lieut.-Colonel. He is an Associate Member of the Institution

of Mechanical Engineers, a Member of the Institution of Locomotive Engineers, and a Member of the Institute of Transport.

Mr. O. E. Kinsman, who, as announced in our issue of June 7, has been appointed Assistant Divisional Superintendent of Operation (Motive Power), Derby, L.M.S.R., entered the service of the former L.N.W.R. at Crewe Works in May, 1905, and after serving four-and-a-half years in the shops and two years in the drawing office, was appointed Assistant to the Motive Power Superintendent at Longsight, in November, 1911. In December, 1912, Mr. Kinsman took up the position of Junior Assistant to the Running Superintendents at Crewe, Messrs. W. H. B. Jones and J. W. Beaumont, and remained in that capacity until August, 1916, when he was transferred to Carlisle to take charge of the steam shed and C.M.E. shops at that depot, together with the district from Oxenholme and Workington to Carlisle. In January, 1919, Mr. Kinsman returned to headquarters at Crewe, and on January 1, 1920, took up the position of Superintendent-in-Charge of the whole of the sheds in the Birmingham area. On the death of the then Chief Mechanical Engineer, Mr. C. J. Bowen Cooke, this post was abolished, and Mr. Kinsman went on to the headquarters staff at Crewe as Assistant (Staff) to the Superintendent of Motive Power, which position he retained until 1927, when he was transferred to Derby in connection with the grouping of the railways, and was appointed as Assistant, Staff and Organisation, Motive Power Section, Chief General Superintendent's Department. In January, 1932, Mr. Kinsman was appointed Assistant Divisional Superintendent of Motive Power (Midland Division), Derby, the position he now vacates.

Mr. D. J. Harris, who, as announced in our issue of June 7, has been appointed Superintendent Marine Engineer, Euston, L.M.S.R., received his early technical training at the Municipal Technical School, Hull, and the Heriot-Watt College, Edinburgh. He served his apprenticeship with Ramage & Ferguson, Leith, and J. Gordon Alison & Co., Birkenhead. He then spent some time afloat as an engineer in the Blue Funnel steamers of Alfred Holt & Co., and holds an extra first-class engineer's certificate. Subsequently he joined the Marine Department of the Board of Trade as an engineer and ship surveyor, in which capacity he worked for over nine years. Mr. Harris joined the old London & North Western Railway as Superintendent Engineer in August, 1918. He was at Holyhead until 1931, when he was transferred to Heysham harbour as Marine Engineer and Superintendent, with charge of the Marine Department there and at Fleetwood.

He now leaves Heysham to take up his new duties at Euston.

Mr. G. S. Simmons, Chief Mechanical Engineer of the Gold Coast Railway, has arrived in England on leave.

Major M. P. Sells, Chief Mechanical Engineer of the Nigerian Railways, arrived in England on May 31.

Mr. Jason Edwards, Chief Accountant, Buenos Ayres Western Railway, sailed for England on leave on May 24.

Mr. F. H. Pank, Assistant Chief Mechanical Engineer, Central Argentine Railway, sailed for England on leave on May 15.

Mr. R. E. Kimberley, Chief Mechanical Engineer of the Buenos Ayres and Pacific Railway, arrived in England on June 4.

We regret to record the death, on June 1, of Señor Don Juan Alvarado, Chairman of the Madrid Saragossa & Alicante (M.Z.A.) Railway. He was born in 1856 and adopted a legal career in which he achieved considerable distinction. Later he became Secretary to the famous statesman Castelar and was identified with successive Liberal Governments in the portfolios of Finance and Justice. The funeral, on June 2, was attended by a large number of M.Z.A. employees of all grades.

#### L.N.E.R. APPOINTMENTS

The London & North Eastern Railway announces the following appointments:—

Mr. J. E. Sharpe, Chief Clerk, Office of Superintendent (Eastern Section), Southern Area, to be Assistant to the Superintendent (Eastern Section), Southern Area.

Mr. J. A. Frampton, District Locomotive Superintendent, Norwich, to be District Locomotive Superintendent, Lincoln, in succession to Mr. S. Gearing, who has recently died.

Mr. H. G. Fish, Assistant District Locomotive Superintendent, Doncaster, to be District Locomotive Superintendent, Norwich, in succession to Mr. Frampton.

Mr. R. W. M'Ewen, Divisional Accountant's office, Edinburgh, to be Chief Assistant to the Divisional Accountant, Southern Area, London, as from July 1.

#### INDIAN RAILWAY STAFF CHANGES

Mr. H. J. Darling, Chief Electrical Engineer, N.W.R., has been granted 4½ months' leave as from May 16.

Mr. H. H. Saunders has been appointed to officiate as Divisional Superintendent (Mechanical), E.I.R., as from March 19.

Mr. G. A. R. Trimming has been appointed to officiate as Chief Mechanical Engineer, E.I.R., as from March 23.

Mr. A. M. Sims has been appointed to officiate as Deputy Chief Engineer, N.W.R., as from April 1.

## British Summer Train Services

(See editorial article on page 1148)

In comparison with the acceleration of train services which has taken place this year in other countries, particularly in the United States, France, and Germany, the changes introduced by British railways with their summer timetables, to be brought into operation on July 8, are modest, though they include one or two notable features, as mentioned hereunder.

### London & North Eastern Railway

The Scarborough Flyer is accelerated to make the 188.2-mile run between King's Cross and York each way in 180 min., at a start-to-stop average of 62.7 m.p.h.; it leaves King's Cross this year at 11.10 a.m., ahead of the Queen of Scots Pullman, and reaches Scarborough at 3.5 p.m., returning at 10.40 a.m., and arriving in King's Cross at 2.35 p.m. Through portions are to run to and from Whitby in both directions, and on the down journey a through portion is carried for Newcastle, which is reached in the hitherto unprecedented time of 4 hr. 50 min. from London; in the reverse direction the 9.35 a.m. from Newcastle connects at York with the Scarborough Flyer, giving a 5-hr. service to London. On Saturdays the King's Cross-York allowance is increased to 3 hr. 10 min., and the train runs in five parts—at 10.55 a.m. to Scarborough only, at 11.10 a.m. to York and Scarborough, at 11.25 a.m. to Whitby, at 11.50 a.m. to Bridlington (via York) and Saltburn, and at 12 noon to Newcastle and Glasgow, all non-stop from King's Cross to York in from 190 to 196 min. The last-mentioned forms one of a series of express trains which will run on Saturdays from King's Cross to Edinburgh, leaving at 9.20 a.m. (non-stop to York in 194 min.), 10 a.m. (the Flying Scotsman, non-stop to Edinburgh), 10.5 a.m., 11.20 a.m. (the Queen of Scots Pullman), 12 noon, 1.20 p.m., and 2.30 p.m., none of them taking more than 7 hr. 55 min., and with an average journey time of 7½ hr., or only 15 min. more than the non-stop Scotsman. Similar provision is made in the up direction, with one express—at 12.15 p.m. from Edinburgh—which will run non-stop to Newcastle (2 hr. 23 min.) and from York non-stop to London (3 hr. 20 min.) in the fastest times of the day, making an overall time of 7 hr. 35 min. to London inclusive of Newcastle, Darlington, and York stops. A through portion from Aberdeen, brought south by the new 9 a.m. express, will be attached to this train, and will give an overall time of 10 hr. 50 min. from Aberdeen to King's Cross, 30 min. quicker than the Flying Scotsman, and the best up booked time on record. Many special through city-to-coast trains will run on Saturdays, a novelty being a train from Manchester to Clacton-on-sea, and *vice versa*, as well as the usual expresses from Leeds, Manchester, Liverpool, and Newcastle to Yarmouth and

Lowestoft, &c. A new restaurant car service will run daily at 11.45 a.m. from Hull to King's Cross, and will attach at Doncaster the through vehicles from Scarborough and Bridlington which in previous years have reached London at 5.20 p.m.; the new arrival is 3.47 p.m.

Sunday services are considerably increased and expedited, in particular the midday Scottish service from London, which will leave at 1 p.m. instead of 12.30 p.m., and reach Edinburgh at 8.40 p.m. Correspondingly, the 11.15 a.m. express from Edinburgh will reach King's Cross at 6.55 p.m. A new fast train for Scarborough and Whitby will leave King's Cross at 11.10 a.m., and other expresses at 10.40 a.m. to Skegness, 12.10 p.m. to Leeds, 12.25 p.m. to Hull, and 1.10 p.m. to Newcastle. The 6 p.m. down express will run in two parts every Sunday, both non-stop to Doncaster in 168 min., the first at 6 p.m. for Newcastle and Hull, and the second at 6.15 p.m. for Leeds and Harrogate.

### Southern Railway

On the Southern Railway principal interest attaches to the new Eastbourne electric services. The expresses will leave Victoria hourly on weekdays and Sundays at 45 min. past the hour, calling at East Croydon, Haywards Heath, and Lewes, taking 84 min. on the journey of 65½ miles; and portions will continue from Eastbourne to Bexhill, St. Leonards, Hastings, and Ore, the time to Hastings being 1 hr. 55 min. from Victoria. The quickest trains on weekdays are additional expresses from London Bridge at 5.4 p.m. and Victoria at 5.20 p.m., calling at Lewes only (where through portions for Seaford are detached) and reaching Eastbourne in 80 min. On Saturdays the service from Victoria to Eastbourne is to be half-hourly, at 15 and 45 min. past the hour. In connection with the hourly expresses from London, hourly stopping trains will leave Haywards Heath at 35 min. past the hour for all stations to Seaford, connecting at Lewes with similar trains from Brighton to Eastbourne, Hastings, and Ore, which will run at half-hourly intervals, calling at all halts as well as at the stations. An hourly service will also be run from Brighton to Seaford, connecting at Lewes with the London expresses. The up express service from Eastbourne is at 36 min. past the hour, and is allowed 86 min. to Victoria; this also is to be half-hourly on Saturdays.

Elsewhere the principal improvement is in the Portsmouth services, and for the first time on record Portsmouth is brought within 90 min. of Waterloo, despite the difficulties of the Portsmouth Direct Line. The 11.50 a.m. non-stop, is due at Portsmouth and Southsea, 73½ miles, at 1.20 p.m. (9 min. acceleration), the 1.50 p.m. on Fridays at 3.25 p.m. (11 min. gain), the 3.50 p.m.

at 5.24 p.m. (9 min.), the 5.53 p.m. at 7.36 p.m. (8 min.), and the 6.50 p.m. at 8.27 p.m. (8 min.). In the reverse direction the 9.54 a.m. and 12 noon up are to be 90-min. trains (6 and 12 min. acceleration, respectively). These substantial gains are made possible by the allocation of "Schools" class 4-4-0 locomotives, in part released by the Eastbourne electrification to the Portsmouth service. On the Western Division main lines there are also some minor accelerations. The Bournemouth Limited is to be accelerated to 118 min. between Waterloo and Bournemouth Central, 108 miles, raising the speed to 54.9 m.p.h.; and by cutting the Waterloo-Salisbury time to 87 min. for the 83½ miles (as in the case of the 3 p.m. down), the 10.35 a.m. section of the Atlantic Coast Express will reach Exeter, 171½ miles, at 1.47 p.m. In the up direction the Exeter-Waterloo time is cut to 3 hr. 10 min. by the corresponding service.

### Great Western Railway

Among notable G.W.R. innovations is the daily division of the Cornish Riviera Express. The first portion, known as the Cornish Riviera Limited, will convey booked seat passengers only, and will be confined to Falmouth, St. Ives, and Penzance portions. The first publicly booked stop will be at Truro, 279½ miles from Paddington, at 3.55 p.m.; the only other stop is St. Erth, and Penzance, 305½ miles, is reached at 4.45 p.m., 6½ hr. after leaving London, and 15 min. earlier than the present time. A second train, at 10.35 a.m., called The Cornishman, will stop first at Plymouth, 225½ miles, in 4 hr. from Paddington, and then at Par, Truro, Gwinear Road, and St. Erth, Penzance being reached at 5.5 p.m. On Saturdays a first portion, at 10.25 a.m., will serve Falmouth and Gwinear Road (for Helston); the 10.30 a.m. will be for St. Ives and Penzance only; the Newquay portion of the 10.35 a.m. will run independently at 10.40 a.m., and the Weymouth slip portion will leave separately at 9.40 a.m., making a total of five trains. In the up direction similar arrangements will be in force, with the Cornish Riviera Limited leaving Penzance at 10 a.m., and not stopping from Truro, though requiring 6 hr. 40 min. to Paddington—25 min. longer than on the down journey—while the up Cornishman will start from St. Erth, make the usual stops to Plymouth, and be 5 min. slower from there to Paddington than when the winter stop is made at Exeter, arriving at 4.50 p.m.

On the Bristol line an important acceleration is that of the 7 a.m. from Weston-Super-Mare to Paddington, now to leave at 7.10 a.m., and Bristol at 7.50 instead of 7.45 a.m., while the Reading slip will be transferred to Didcot, in place of the present stop there. By covering the 94 miles from Chippenham to Paddington in 93 min., this train will arrive at 10 instead of 10.15 a.m., a total gain of 25 min. New buffet car express services have been arranged

between Paddington, Oxford, and Worcester, down at 10.15 a.m. (with a 65-min. run to Oxford), and up at 4.10 p.m., the latter being booked over the 63.5 miles from Oxford to Paddington in 60 min. The journey time is 2 hr. 23 min. down and 2 hr. 25 min. up, with stops at Kingham, Moreton, and Evesham; and through coaches are run to and from Hereford. A further improvement of the same service is given by a pair of new streamlined railcars, which are to run from Oxford to Hereford and back, connecting at Oxford with certain London trains, and are to complete an energetic daily round filling in gaps in various branch timetables. One will begin the day at Oxford, and run in succession to Kingham, Oxford, Hereford, Oxford, Princes Risborough, Oxford, and Didcot; and the other, commencing at Worcester, will run to Malvern Wells, Birmingham, Henley-in-Arden, Birmingham, Worcester, Malvern Wells, Broadway, Stratford-on-Avon, Oxford, and Worcester. Finally, in conjunction with the L.M.S.R., the G.W.R. is introducing express business services twice daily in each direction between Swansea and Manchester. Leaving Swansea at 7.45 a.m. and 5.5 p.m., and Cardiff at 9 a.m. and 6.20 p.m., Manchester will be reached, via Hereford and Shrewsbury, at 1.20 and 10.30 p.m.; in the reverse direction, leaving Manchester at 8.20 a.m. and 6.17 p.m., Cardiff will be reached at 12.26 and 10.26 p.m., and Swansea at 1.40 and 11.40 p.m. Between Cardiff and Manchester these trains, which will carry restaurant cars, will be 30 to 45 min. quicker than any existing service.

#### London Midland & Scottish Railway

Apart from the new Manchester-Swansea services just mentioned, the most notable L.M.S.R. innovation is the division of the 5.20 p.m. from Euston, the first part, at 5.10 p.m., providing the return evening working of the Fylde Coast Express. The first stop will be at Crewe, at 7.55 p.m., and the next at Wigan, where a through portion will be detached for Colne via Chorley and Blackburn. Blackpool will be reached 43 min. earlier than at present—an acceleration of 33 min. In Scotland a new service, similar to that recently instituted by the L.N.E.R. from Aberdeen to Edinburgh, will leave Aberdeen for Glasgow at 9.15 a.m., reaching Buchanan Street at 12.45 p.m., returning at 7.15 p.m., and calling, as on the south-bound journey, at principal stations, this express will reach Aberdeen at 10.51 p.m.

#### AFRICAN RAILWAY FINANCE CO. LTD.

—The list of applications for an issue by this company of £571,000 of 2 per cent. guaranteed debenture stock, 1948-1951, which has been guaranteed as to principal and interest by the British Treasury under the provisions of the Finance Act, 1934, was opened and closed on Friday, May 31. Applications from small subscribers were ruled out and larger applicants received about 9 per cent. of their requirements.

## QUESTIONS IN PARLIAMENT

### British Capital in Argentine Railways

Mr. Burnett, on June 5, asked the Secretary of State for Foreign Affairs whether he would, before permission was asked to float another Argentine loan in London, point out to the Argentine Government that the lack of sympathy of Argentine nationals towards foreign capital sunk in Argentine railways and other enterprises had discouraged the further investment of British savings in Argentina.

Mr. Eden (Lord Privy Seal) replied.—I can assure my hon. friend that the position of British capital in Argentina will continue to receive the closest consideration. It is not possible to say in advance what matters may fall to be discussed with the Argentine Government before any question of another issue of Argentine Government bonds arises.

### Number of Level Crossings

Mr. David Grenfell, on June 5, asked the Minister of Transport whether he would state the number of railway level crossings on Class A roads and on other roads, respectively; and giving separate figures for England, Scotland and Wales.

Mr. Hore Belisha.—The figures in respect of first- and second-class roads are:—

	Railway Crossings		Colliery Crossings		Total
	Class I	Class II	Class I	Class II	Class I & II
England (excluding Monmouth)	500	375	157	90	1,122
Scotland ...	22	2	9	—	33
Wales and Monmouth	91	63	26	50	230
Totals ...	613	440	192	140	1,385

As regards unclassified roads, separate figures are not available, but the total of all railway level crossings of public roads in Great Britain is, I am informed, 4,567.

### Railway Valuation

Sir Percy Hurd on June 7 asked the Minister of Health whether his attention had been called to the difficulties experienced by rating authorities in consequence of the uncertainty as to the correct legal basis of valuation for railways; whether he was aware that the decision of the Railway and Canal Commissioners in the case of the Southern Railway, having been applied by the railway assessment authority to the London & North Eastern Railway, had resulted in a nil assessment of that railway; that under these decisions rating authorities must make great increases in the rates in order to repay the railway companies; and whether steps could be taken to expedite a final decision in the Southern Railway case so that rating authorities might ascertain what, if any, increase should be levied in the next rate period.

Sir Hilton Young.—My attention has been called to the facts stated in the

question. While I am not myself in a position to take any steps to expedite proceedings which are already before the Courts, I have no doubt that the parties themselves are fully alive to the importance of obtaining a final decision as soon as possible.

### Palestine Railway Development

Mr. Janner asked the Secretary of State for the Colonies on June 7 whether he would give an assurance that before any decision was reached with regard to the recommendations contained in the report of Sir Felix Pole on Palestine railway development the contents of the report would be published, so that interested bodies might have an opportunity of expressing their opinion on the proposals contained therein.

Sir P. Cunliffe-Lister.—The question of the publication of Sir Felix Pole's report will be considered when the views of the High Commissioner for Palestine have been received.

## Northern Belle Train Cruises, L.N.E.R.

On page 1170 we reproduce two photographs of the Northern Belle taken last week during the first of its cruises this season. The Northern Belle left King's Cross last Friday on its second cruise with a complement of 60 passengers, and we understand that the two remaining cruises which start on June 21 and 28 are fully booked.

The itinerary of each six days' tour covers the English Lake District, Aberdeen, Grantown-on-Spey, Deeside, Braemar, via Balmoral, the West Highland line right up to Fort William and Mallaig, Loch Lomond, and Loch Long, concluding with a day in and around Edinburgh. Notwithstanding the many encomiums received by the L.N.E.R. on the Northern Belle cruising train during the past two years, the arrangements for the 1935 cruises are even better as the itinerary and general facilities offered are the outcome of actual experience.

The whole train comprises 14 vehicles, weighs 511 tons, and has a total length of 885 ft. The night portion is composed of a brake-van and 6 first class sleeping cars, three of which are fitted with shower-baths. The day portion comprises a brake, first and third class sleeper for the accommodation of the staff (which totals 28), kitchen car, two first class dining cars, special coach containing hairdressing saloon, cocktail bar, &c., and a saloon.

This year the souvenir booklet presented to each passenger is appropriately and attractively finished with a silvered cover tied with a "jubilee blue" bow, and bears, in addition to the L.N.E.R. crest, the words "Silver Jubilee Year." It contains a route map of the cruise, the itinerary, some attractive views of places visited, and a folding plan of the complete train.

## NOTES AND NEWS

### Steam Locomotive Speed Record.

—What is believed to be the highest speed so far attained by a steam locomotive has been achieved by the second of the new streamlined locomotives for the German State Railway built by the Borsig Locomotive Works. When hauling a trial train weighing 200 tons between Berlin and Hamburg a few days ago, 192 km.p.h. (119 m.p.h.) was reached. Speeds of 165 to 175 km.p.h. (102.3—108.5 m.p.h.) were maintained over long distances.

### Fort William Town Council Supports the L.N.E.R.

—Fort William Town Council has refused the request of David MacBrayne (1928) Limited to support a mandate to the Traffic Commissioners asking for alterations in the bus service timetable. Bailie Devlin moved that the council take no action, and said the effect would be to take away traffic from the L.N.E.R. He added that the sympathy of the council should be with the L.N.E.R., which, during the past three years had paid £1,910 in rates to the burgh, whereas MacBrayne had paid £114 in the same period.

**Road Accidents.**—The Ministry of Transport return for the week ended June 8 of persons killed or injured in road accidents is as follows. The figures in brackets are those for the corresponding week of last year:—

	Killed, including deaths resulting from previous accidents	Injured
England ...	100 (131)	3,868 (4,307)
Wales ...	4 (6)	145 (205)
Scotland ...	10 (17)	351 (459)
	114 (154)	4,364 (4,971)

The total fatalities for the previous week were 98, as compared with 134 for the corresponding period of last year.

### New Railway Conciliation Machinery.

—Sir Ralph Wedgwood, Chief General Manager of the London & North Eastern Railway, expressed satisfaction with the new conciliation machinery between the railway companies and trade unions, when he spoke at a luncheon of the Industrial Co-Partnership Association, in London on June 5. "We have a machinery of negotiation of which we are very proud," he said. "I think I can speak with certainty for the trade unions as well as for the officials and the railway companies. I believe we have got an organisation which will be thoroughly successful. The machinery may appear complicated, and it is certainly expensive. It is not expensive, however, when you consider the importance of the object to be achieved. That object is first to prevent strikes, for one day's strike will involve more expense than a year's council meetings, with all the staff and clerks' salaries thrown in. The second, and more important object, is the maintenance of good feeling in the railway service. The aim is that the staff in all grades should feel they get a fair hear-

ing and a just decision without undue delay on the hundreds of grievances, little and big, which inevitably arise in a complicated service like the railways. A good spirit is essential to the revenues and reputation of the companies."

### Road and Railway Transport Bill (Northern Ireland).

—The third reading of this Bill was carried by 24 votes to 1 in the Northern Ireland House of Commons on June 4, when the Bill was passed and ordered to be carried to the Senate. A fair number of amendments had been made in Committee, mostly of a drafting nature. The two principal alterations were (i) in Clause 15, which as amended will allow farmers to carry for and help neighbouring farmers up to any extent to which the Minister of Home Affairs may agree (ii) that persons employed by transport undertakings for two years previous to transfer shall be entitled to compensation if their services are not retained. In the original Bill the period was three years.

### Further Details of the Quetta Earthquake.

—In the course of an interview by Reuters, Sir Guthrie Russell, Chief Commissioner of Railways in India, stated that the minimum estimate of the cost of the earthquake damage to railway property at Quetta was £300,000. He said, however, that the question of reconstruction would be considered later, after a decision had been reached with regard to the future of Quetta as a whole. It was significant, he pointed out, that earthquake-proof bungalows built after the previous earthquake in 1913, had remained undamaged. In testifying to the heroism and magnificent work done by the railway staff, Sir Guthrie mentioned one Assistant Stationmaster near Quetta who carried on single-handed for 48 hours on duty, in spite of the fact that all members of his family had been killed.

### Southern Railway Dock Rebates.

—Dock de-rating rebates under the Local Government Act, 1929, are announced as applicable as from April 1, 1935, at Southern Railway docks, as follows. For coal, coke and patent fuel shipped at the port, 3d. a ton; for pitwood, &c., imported, 10 per cent. of the dues; for iron ore imported, 1½d. a ton; for iron and steel (classes 5 to 10 of the railway classification) and tin plates shipped at the port—(a) other than coastwise, 4d. a ton, (b) coastwise, 7½ per cent. of the dues; for other merchandise—(a) shipped at Southampton docks, 15 per cent. of the dock charges applicable, (b) shipped at other ports, 7½ per cent. of the dues; for timber imported through Southampton docks, 20 per cent. of the dock charges applicable; for wool, hides, and skins imported through Southampton docks, 33½ per cent. of the dock charges applicable; for Empire butter and cheese, 20 per cent. of the import rate; for

Empire wine and eggs, 10 per cent. of the import rate. On charges for use of electric cranes at Southampton docks a rebate of 20 per cent. is allowed.

### Civil Engineers' Conversazione.

Sir Richard A. S. Redmayne, President, and the Council of the Institution of Civil Engineers, held their annual conversazione on Wednesday night, when the guests included a number of distinguished persons. Besides lectures by Dr. H. Spencer Jones, M.A., F.R.S., Astronomer Royal, on Giant Telescopes, Dr. H. J. Gough, M.B.E., F.R.S., on Robert Hooke (1635-1703), and Air Commodore P. F. M. Fellowes, D.S.O., on the Houston Mount Everest Flight, there was the usual interesting exhibition of engineering models and scientific apparatus, as well as excellent musical programmes.

### A Special L.N.E.R. Scenic Excursion.

—Five trains of L.N.E.R. tourist stock were used on a special scenic excursion from York, organised for local schoolchildren, on Empire Day, May 24. The party consisted of 1,600 children accompanied by 110 teachers and the route selected, via Coxwold, Helmsley, Pickering, Whitby and Scarborough, was rich in historical and geographical interest, as well as including a variety of moorland and coastal scenery. Other special scenic excursions from Redcar and Billingham organised by the L.N.E.R. during the Jubilee celebrations were referred to in an editorial note on page 1014 of our issue of May 24.

### Ottoman Railway from Smyrna to Aidin.

—At meetings of the first and second debenture stockholders and of the preference and ordinary shareholders of the Ottoman Railway from Smyrna to Aidin held on June 7, the scheme of arrangement put forward by the directors in consequence of the proposed sale of the railway to the Turkish Government was approved by large majorities of the debenture holders, and there was no opposition vote by preference or ordinary shareholders. The 1st debenture holders' vote by stocks was £1,446,870 for, and £2,350 against; 2nd debenture holders, £1,090,260 for, and £3,530 against; preference shareholders £142,540 for; ordinary shareholders £435,260 for.

**Airports Limited.**—A new company, registered as Airports Limited, has recently been formed to acquire Gatwick and Gravesend airports, and to develop them as aerodromes for Continental and internal air services. The authorised share capital is £275,000, of which £240,000 has been offered to the public in the form of 840,000 ordinary 5s. shares at par, and allocations of 120,000 shares to vendors in part satisfaction of purchase considerations. Among the other objects of the company are the acquisition of the benefit of payments to be made by the Air Ministry for a period of 15 years in consideration of the installation of night-flying equipment at the company's airports; the acquisition of the benefit of an agreement made with the Southern

Railway Company to build a railway station at Gatwick Airport, and the erection of a Martello-type terminal air station at Gatwick. A Martello air station, it is explained, is a multi-sided structure around which aircraft may taxi to take up allotted berths. Each side will berth the largest air liners. The centre of the building is a circulating area and booking hall for passengers from which radial passage-ways give direct access to waiting aircraft, and a short subway communicates directly with the railway station. A restaurant and buffet will be provided in this building. The building can deal with the arrival or departure of six of the largest type of passenger aeroplanes at the same time, whereas only one incoming and one outgoing machine can efficiently be dealt with simultaneously at existing terminal buildings elsewhere in Europe. The Chairman of the company is Viscount Goschen, who is supported, amongst others on the board, by Sir Felix Pole.

**Railway Congress in Brazil.**—It has been decided to hold a Railway Congress in Brazil in October next, in commemoration of the centenary of the first railway law passed in that country. The congress will be held in the city of Campinas, a railway centre of considerable size in the State of São Paulo, and is being organised under the auspices of the Associação de Engenheiros de Campinas. It has the active support of the Federal Government, the Government of the State of São Paulo, the railways, suppliers of railway materials, and a number of engineering associations. The congress is intended to cover the discussion of the technical and law-making branches of railway working as applied to Brazil, and will also include a two-days tour, embracing trips over a number of railways in the State of São Paulo. An exhibition of railway material of historical and present-day interest is also being organised in conjunction with the congress and will be held in Campinas.

## British and Irish Railways Stocks and Shares

Stocks	Highest 1934	Lowest 1934	Prices	
			June 12, 1935	Rise Fall
G.W.R.				
Cons. Ord. ....	661½	481½	50	+2
5% Con. Prefce. ....	118	109	119½	+½
5% Red. Pref. (1950) ..	115	107	111½	—
4% Deb. ....	117	105	116	+½
4½% Deb. ....	119	109	116½	—
4½% Deb. ....	129½	115½	126½	+½
5% Deb. ....	135	126½	137½	—
2½% Deb. ....	75	64	78½	—
5% Rt. Charge .....	1347½	123½	135½	—
5% Cons. Guar. ....	132½	121½	131	+½
L.M.S.R.				
Ord. ....	301½	191½	20	+1½
4% Prefce. (1923) .....	64½	41	56	+3½
4% Prefce. ....	87	69½	80	+½
5% Red. Pref. (1955) ..	107	92½	102½	—
4% Deb. ....	114½	100½	107*	-1½
5% Red. Deb. (1952) ..	118½	111½	115½	—
4% Guar. ....	106½	96½	103	—
L.N.E.R.				
5% Pref. Ord. ....	243½	131½	13	+1½
Def. Ord. ....	11½	67½	61½	+½
4% First Prefce. ....	76	59½	62	+3½
4% Second Prefce. ....	47	25½	26	+3
5% Red. Pref. (1955) ..	94½	80	81½	+1
4% First Guar. ....	104	92	100½	—
4% Second Guar. ....	97½	86½	92½	—
3% Deb. ....	90	74½	81½*	-1½
4% Deb. ....	114	99½	106½*	-1
5% Red. Deb. (1947) ..	117	108	113½	—
4½% Sinking Fund Red. Deb. ....	111½	105½	109*	-2
SOUTHERN				
Pref. Ord. ....	90	63½	85	+1
Def. Ord. ....	32½	19	24½	+½
5% Prefce. ....	118½	107½	120	+1
5% Red. Pref. (1964) ..	115½	107½	115½	—
5% Guar. Prefce. ....	132	120½	130	—
5% Red. Guar. Pref. (1957) ..	119½	113	118½	—
4% Deb. ....	116½	103½	113*	-1½
5% Deb. ....	134	124½	133½*	-2
4% Red. Deb. ....	113½	105½	111*	-1½
1962-67				
BELFAST & C.D.				
Ord. ....	6	5	4	—
FORTH BRIDGE				
4% Deb. ....	110	100	107½*	-2
4% Guar. ....	110	100	107½*	-1
G. NORTHERN (IRELAND)				
Ord. ....	95½	41½	9	—
G. SOUTHERN (IRELAND)				
Ord. ....	25	12½	25	-2½
Prefce. ....	21½	13½	33½	+1½
Guar. ....	48	39	65	—
Deb. ....	67	59	77½	-1½
L.P.T.B.				
4½% "A" ....	126	115	124½*	—
5% "A" ....	135½	124½	133½*	—
4½% "T.F.A." ....	113½	107½	111*	—
5% "B" ....	131½	118	127½*	—
5% "C" ....	97	73	100	—
MERSEY				
Ord. ....	15½	7	12	—
4% Perp. Deb. ....	93½	82½	95½	—
3% Perp. Deb. ....	66½	61½	69½	—
3% Perp. Prefce. ....	54	44½	52½	—

\* ex-dividend

## British and Irish Traffic Returns

GREAT BRITAIN	Totals for 23rd Week			Totals to Date		
	1935	1934	Inc. or Dec.	1935	1934	Inc. or Dec.
<b>L.M.S.R. (6,926½ mls.)</b>						
Passenger-train traffic...	609,000	469,000	+ 140,000	9,666,000	9,491,000	+ 175,000
Merchandise, &c.	458,000	456,000	+ 2,000	10,301,000	10,225,000	+ 76,000
Coal and coke	218,000	191,000	+ 27,000	5,590,000	5,569,000	+ 21,000
Goods-train traffic	676,000	647,000	+ 29,000	15,891,000	15,794,000	+ 97,000
Total receipts	1,285,000	1,116,000	+ 169,000	25,557,000	25,285,000	+ 272,000
<b>L.N.E.R. (6,336 mls.)</b>						
Passenger-train traffic...	374,000	304,000	+ 70,000	6,296,000	6,155,000	+ 141,000
Merchandise, &c.	301,000	299,000	+ 2,000	7,079,000	7,149,000	- 70,000
Coal and coke	213,000	204,000	+ 9,000	5,292,000	5,411,000	- 119,000
Goods-train traffic	514,000	503,000	+ 11,000	12,371,000	12,560,000	- 189,000
Total receipts	888,000	807,000	+ 81,000	18,667,000	18,715,000	- 48,000
<b>G.W.R. (3,749½ mls.)</b>						
Passenger-train traffic...	247,000	192,000	+ 55,000	4,009,000	3,989,000	+ 20,000
Merchandise, &c.	193,000	186,000	+ 7,000	4,137,000	4,092,000	+ 45,000
Coal and coke	96,000	93,000	+ 3,000	2,335,000	2,355,000	- 20,000
Goods-train traffic	289,000	279,000	+ 10,000	6,472,000	6,447,000	+ 25,000
Total receipts	536,000	471,000	+ 65,000	10,481,000	10,436,000	+ 45,000
<b>S.R. (2,171 mls.)</b>						
Passenger-train traffic...	368,000	314,000	+ 54,000	6,035,000	5,916,000	+ 119,000
Merchandise, &c.	56,000	64,000	- 8,000	1,369,000	1,459,000	- 90,000
Coal and coke	21,000	22,000	- 1,000	716,000	753,000	- 37,000
Goods-train traffic	77,000	86,000	- 9,000	2,085,000	2,212,000	- 127,000
Total receipts	445,000	400,000	+ 45,000	8,120,000	8,128,000	- 8,000
<b>Liverpool Overhead (6½ mls.)</b>						
Mersey (4½ mls.)	1,184	1,230	- 46	25,641	25,208	+ 433
* London Passenger Transport Board	3,801	4,058	- 257	93,292	95,766	- 2,474
<b>IRELAND</b>						
Belfast & C.D. pass.	2,677	2,836	- 159	45,505	44,027	+ 1,478
" " goods	380	466	- 86	11,374	12,217	- 843
" " total	3,057	3,302	- 245	56,879	56,244	+ 635
Great Northern pass.	10,200	9,500	+ 700	201,050	184,100	+ 16,950
" " goods	8,200	8,200	—	206,850	199,400	+ 7,450
" " total	18,400	17,700	+ 700	407,900	383,500	+ 24,400
Great Southern pass.	24,537	23,866	+ 671	474,513	467,330	+ 7,183
" " goods	32,106	31,830	+ 276	804,018	745,011	+ 59,007
" " total	56,643	55,696	+ 947	1,278,531	1,212,341	+ 66,190

\* 49th week, the receipts for which include those undertakings not absorbed by the L.P.T.B. in the corresponding period last year; last year's figures are, however, adjusted for comparative purposes.  
N.B.—Whitsun day 1935

## L.N.E.R. Poster Art

When confronted with the large number of beautiful posters produced annually by the L.N.E.R., the reviewer's first care is to classify them under headings less invidious than that of artistic merit. Were this not done, all would claim to share the highest place, and a critical view of the whole would be hard to achieve. Fortunately, railway publicity can be broadly defined as territorial, local, and advertisement of facilities, such stragglers as fall into none of these groups being inconsiderable in number.

East Anglia is naturally well represented among territorial advertising,

ing a child bather engrossed in the contents of a seaside pail.

Among the posters representing specific resorts and centres of interest there are two fine pieces of pictorial work, one showing Barnard Castle and the other Aysgarth Falls, by E. W. Haslehurst. These, as befits the beauty of their subjects, are serious landscape studies, and it is to be hoped that they will be displayed in situations such as refreshment and waiting rooms, where the public is likely to be in a contemplative mood. Most of the other artists in this category have handled their scenes with a lightness and gaiety

spirit in its lively or graceful moods. There is plenty of harmonious animation and cheerful colour in the work of L. Hankey, who gives us the flower market at Norwich and a quayside scene at Dordrecht. Doris Zinkeisen adds to these qualities a touch of the picturesque and an element of humour in her portrayal of a promenade scene at Scarborough entitled "In Grandmother's Day." Frank Newbould's study of Bridlington strikes a pleasant note in its handling of brown sails, red funnels, and holidaymakers, while Tom Purvis has broken away from the scenic theme to epitomise the pleasures of Whitley Bay in a gaily coloured impression of bathers, in which masses of yellow and blue ensure notice wherever



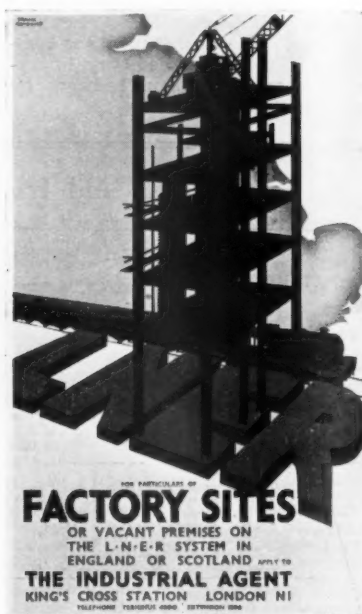
the most pleasing and original poster in this group being a reproduction of a linocut by G. W. Taylor, with a figure on horseback giving unhurried life to a scene of undulating fields and winding lanes. The text reads "Explore East Anglia," and the same slogan appears below a bird's eye view of the Eastern Counties by Montague B. Black. From this design the beholder gains the sense of space and sunshine he would experience if he saw the same landscape from an aeroplane thousands of feet above the ground on a clear day of early summer.

More familiar ingredients make up the appeal of S. E. Scott's poster for the Norfolk coast. The central figure is a girl reclining in a field of poppies, with bathers as a background, but it is the artist's lavish use of red, yellow, and blue, ingeniously contrived by his choice of subjects, which first arrests the attention. The East Coast as a whole is the theme of another poster, which is an attractive reproduction of a photograph in natural colours show-



ing touch and colour dictated by the nature of the originals, but before considering their work mention must be made of four more sober examples. One of these, "St. John's Bridge, Cambridge," is from a linocut by G. Raverat, and is artistically noteworthy for the skill with which the artist has expressed sunlight, shadow, and reflections in the water, despite a seemingly awkward medium for the purpose. Sydney Lee, R.A., has done a pen and ink drawing of Fountains Abbey, the first poster he has designed. It is a graceful piece of work, skilfully set off by the use of foliage as a frame and background to the tower that rises with such impressive solidity above the ruins. A view of Lincoln Cathedral by Frank Newbould, in which architectural beauty is well brought out without pedantic attention to detail, and Frank M. Mason's fine night scene of the tunny fleet at Scarborough, complete the list.

The remainder of the posters in this class are imbued with the holiday



the poster is shown. Another of the L.N.E.R. series of seaside views framed in a window of a railway carriage, this time of Felixstowe, appears over the signature of Michael. A. Johnson has executed a pleasant scene in the spa at Harrogate, in which the grace of the ladies and the complexions of the gentlemen testify to the excellent medicinal properties of the waters.

And so we come to the posters advertising railway facilities, of which the first to evoke comment must surely be that of the Flying Scotsman reproduced herewith. Travellers of all ages and both sexes will be impelled to investigate the unusual appendix to the smokebox of the Pacific, and will rejoice at the subtlety of the underline, which reads "a smart turn out." But we can imagine that it may be regarded by some as a picture of a locomotive spoilt by a woman, or of a woman spoilt by a locomotive.

Originality has found more satisfying expression in the other two designs reproduced, both by Frank

## OFFICIAL NOTICES

## South Indian Railway Company Limited

**T**HE Directors are prepared to receive Tenders for the supply of:—

## TWO 10-TON HAND TRAVELLING CRANES.

Specifications and Forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W.1.

Tenders addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for Hand Travelling Crane," with the name of the firm tendering, must be left with the undersigned

not later than 12 NOON on Friday, the 5th July, 1935.

The Directors do not bind themselves to accept the lowest or any tender.

A charge, which will not be returned, will be made of 10s. for each copy of the Specification.

Copies of the drawings may be obtained from the Company's Consulting Engineers, Messrs. Robert White & Partners, 3, Victoria Street, Westminster, S.W.1.

A. MUIRHEAD,  
Managing Director.

91, Petty France,  
Westminster, S.W.1.  
12th June, 1935.

**P**ATENTS for Inventions, Trade Marks, Advice, Handbook, and consultations free. King's Patent Agency, Ltd. (B. T. King, C.I.M.E., Registered Patent Agent, G.B., U.S., and Canada), 146A, Queen Victoria Street, London, E.C.4. 49 years' references. 'Phone City 6161.

## Universal Directory of Railway Officials and Railway Year Book

40th Annual Edition, 1934-35  
Price 20/- net.

THE DIRECTORY PUBLISHING CO. LTD.,  
33, Tothill Street, London, S.W.1.

Newbould, though here, of course, we are comparing the latitude open to the artist with the more prosaic effects at the command of the photographer.

Certainly the most impressive poster in the "facilities" class is "The Night Parade" by Frank M. Mason, advertising Continental services from

Harwich. The ss. *Vienna* is shown sailing, with a background of other vessels at the quayside. The midnight blue of sky and sea, the dark mass of the ships, and the yellow twinkle of lights, combine in a stirring panorama.

Two famous L.N.E.R. hotels have been portrayed by Michael, with an

attractive ballroom scene in the Royal Station Hotel at York and a view of the dining room in the North British Station Hotel at Edinburgh. A poster-size reproduction of the "Holiday Handbook" cover has been issued as a more general incentive to the investigation of L.N.E.R. facilities.

## CONTRACTS AND TENDERS

Michelin & Company has received an order for one metre-gauge and one 3 ft 6 in.-gauge petrol-driven pneumatic-tired railcar of the latest 42-46 seater type for the Mozambique Railways.

## Big Diesel Orders

The Società Anonima Fiat, of Turin, has received an order from the Italian State Railways for 100 double-bogie, double-engined 160-b.h.p. Littorina railcars of the diesel type. These cars are to have a seating capacity of 56 and a maximum speed of 68 m.p.h. The Fiat Company has also booked an order for six double-engined 290-b.h.p. diesel railcars from the Northern Railway of Spain and six similar cars for another Spanish line. Parts of the body and chassis will be built in Spain. Finally, the Russian Government has placed an order with Fiat for two 240-b.h.p. petrol railcars with a top speed of 80 m.p.h.

Bayliss, Jones & Bayliss Limited has received an order for 90,000 fishbolts, nuts and washers for 85-lb. rails for the Central Argentine Railway.

Oerlikon Limited has received an order from the South Indian Railway for the supply of one electrolyser plant to the inspection of Messrs. Robt. White & Partners.

C. M. Hill & Co. Ltd., on behalf of Usines Acieries Allard, has received an order for 109,000 mild steel dog-spikes for the Cordoba Central Railway.

Cowans, Sheldon & Co. Ltd. has received an order from the Chinese Government Purchasing Commission, on behalf of the Ministry of Railways, China, for one 30-ton steam locomotive crane for the Canton Hankow Railway, to be supplied to the inspection of Messrs. Fox & Mayo.

The Canadian National Railways Administration has placed orders for a total of 80,000 tons of steel rails divided equally between the Dominion Steel & Coal Co. and the Algoma Steel Corp.

The Crown Agents for the Colonies have recently placed orders as follows:—

Carron Co. Ltd. and Cochran & Co. (Annan) Ltd.: Boilers.  
Siemens Bros. & Co. Ltd.: Cable.  
Nuts & Bolts (Darlaston) Limited: Clip bolts.  
R. Johnson & Nephew Limited: Copper wire.  
English Drilling Equipment Co. Ltd.: Drilling machine.  
Kitson & Co. Ltd.: Locomotive boiler.  
Brown Bayley's Steel Works Limited: Locomotive tyres.  
Whitehead Iron & Steel Co. Ltd.: Mild steel bars.  
P. & W. MacLellan Limited: Mild steel rivets, bars, plates and rounds and steel joists.  
Yates Improved Rail Anchor Co. Ltd.: Rail anchors.  
Lancashire Steel Corporation Limited: Rail clips.  
British (Guest, Keen & Baldwins) Iron & Steel Co. Ltd.: Rails, fishplates and steel sleepers.  
C. Richards & Sons Ltd.: Rivets.  
Wolverhampton Corrugated Iron Co. Ltd.: Steel sheets.  
Horsehay Co. Ltd.: Steel bridgework.  
Isca Foundry Co. Ltd.: Switches and crossings.  
Braithwaite & Co. (Engineers) Ltd.: Tanks.  
R. A. Dyson & Co. Ltd.: Trailers.  
Stewarts and Lloyds Limited: Tubes.  
J. Stirk & Sons Ltd.: Veloplane.  
R. Hudson Limited: Wheels for tip wagons.  
J. Stone & Co. Ltd.: White metal.

The Swedish State Railways Administration has bought over 70,000 tons of engine coal, including 43,550 tons of British brands (Broomhill, South Hetton, Horden, Wemyss, Maude, East Hetton, and Lambton) at prices varying between 16s. 2½d. and 19s. 11½d., and 30,000 tons of Flammstueck at 18s. to 18s. 9d. Also 5,000 tons of Bunkernuesse have been purchased.

The Bombay, Baroda & Central India Railway invites tenders receivable at the White Mansion, 91, Petty France, Westminster, S.W.1, by June 26, for the supply of chemically-dressed wagon covers.

Reuters Trade Service learns from New York that the Chesapeake & Ohio Railroad invites tenders for what is believed to be the largest railway equipment order of the year, namely, for five heavy high-speed modern passenger locomotives, 5,000 steel hopper coal cars of 62½ tons capacity, 50 live-stock cars and 75 flat cars. It is expected that the total order will involve about \$11,000,000 and the financing

will be done through the sale of equipment trust certificates and not through a loan from the Public Works Administration. The locomotives will be of exceptionally powerful type with very large fireboxes and capable of maintaining high speeds with heavy passenger steel trains. The engines will not be streamlined. In some quarters this inquiry is looked upon as the beginning of a definite improvement in the demand for heavy goods from the railways.

## Railway and Other Reports

## Rohilkund &amp; Kumaon Railway.—

An interim dividend of 4 per cent., and a bonus of 2 per cent. on the ordinary stock (the same), will be paid, less tax at 2s. 5d. in the £, on July 29.

## Bengal &amp; North Western Railway.

—After placing, as usual, £35,000 to sinking fund, the directors have declared an interim dividend for the half-year ended March 31 of 4 per cent., together with a bonus of 4 per cent. on the ordinary stock (unchanged), payable, less tax at 2s. 6d. in the £, on July 29.

## West of India Portuguese Guaranteed Railway.—

The report for the year ended December 31, 1934, shows that earnings increased from Rs. 28,88,501 to Rs. 31,73,228, and expenditure was reduced from Rs. 18,14,094 to Rs. 17,40,711, so that net revenue rose from Rs. 10,74,406 to Rs. 14,32,516. The operating ratio for the railway was 57.58 per cent. for 1934, against 65.54 for 1933. A dividend of 2½ per cent. actual and a bonus out of reserve of 1 per cent. actual, making a total of 3½ per cent. actual, will be paid on July 15 in respect of the half-year to June 30, 1935.

## Forthcoming Events

June 20 (Thurs.)—Institution of Electrical Engineers, at Natural History Museum, Cromwell Road, London, S.W. 7, 8.30 p.m. Conversazione.

June 21-25.—Institution of Railway Signal Engineers, in Belgium. Summer Meeting.

## Railway Share Market

The stock and share markets opened the current week with an unexpectedly good accumulation of orders and home railway stocks participated in the demand. The market appears inclined to take a more favourable view of the wages position, which it was anticipating a week ago would be a hindrance to a renewal of public interest in this market. There is also a disposition to look for satisfactory interim statements despite some disappointment caused by lack of expansion in traffic receipts to date.

Wednesday's returns, which include part of the Whitsun holiday traffic, were regarded as satisfactory; the increases were, if anything, in excess of market estimates. Prices of the leading stocks did not show any material alteration. London & North

Eastern issues have been prominent of late on the Government's plan of assisting in the financing of electrification, and both the preferred and deferred ordinary stocks have been marked up. They are still only at about half the prices reached at one time last year. The main interest is still centred in the company's first and second preference stocks. It is unofficially estimated that the full 4 per cent. is being earned on the first preference stock with a modest surplus for the second preference. On the basis of the full 4 per cent., the first preference stock gives the high yield of 6½ per cent., or about twice the rate obtainable from gilt-edged stocks. A line of £350,000 of 4 per cent. debenture stock has been sold privately by the company recently,

and a block of £150,000 has this week come into the market where it is on offer at 107, free of stamp. In the foreign railway market interest in Argentine issues is not as strong as before the holiday, although Buenos Ayres Great Southern ordinary attracted some attention.

Cordoba Central debenture stock was sold by operators who have a substantial profit. The market is awaiting news of the terms on which the line may be taken over by the Government. Antofagasta preference and debenture stocks rose on the board's statement explaining the method of converting currency receipts into sterling and intimating that a relatively small amount will require to be reserved in the 1935 accounts for exchange losses.

### Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

Railways	Miles open 1934-35	Week Ending	Traffic for Week		No. of Weeks	Aggregate Traffic to Date			Shares or Stock	Prices				
			Total this year	Inc. or Dec. compared with 1934		Totals		Increase or Decrease		Highest 1934	Lowest 1934	June 12, 1935	Yield % (See Note)	
						This Year	Last Year							
South & Central America.														
Antofagasta (Chili) & Dolivia	830	9.6.35	12,770	+ 2,090	23	£84,980	290,240	—	£ 5,260	Ord. Stk.	263½	19	19½	Nil
Argentine North Eastern	753	1.6.35	9,175	+ 1,151	48	358,863	394,863	—	36,000	"	11	6½	7	Nil
Argentine Transandine	111	—	—	—	—	—	—	—	—	A. Deb.	52	45	32½	125½
Bolivar	174	May, 1935	7,100	+ 500	21	33,400	33,650	—	250	6 p.c. Deb.	10	6½	10	Nil
Brazil	—	—	—	—	—	—	—	—	—	Bonds.	133½	107½	13	31½
Buenos Ayres & Pacific	2,806	8.6.35	88,935	+ 8,648	49	3,911,611	4,186,075	—	274,464	Ord. Stk.	163½	8½	8	Nil
Buenos Ayres Central	190	26.5.35	\$113,200	+ \$11,500	47	\$5,175,900	\$4,998,000	—	\$177,900	Mt. Deb.	23	10	2½	Nil
Buenos Ayres Gt. Southern	5,085	8.6.35	128,723	+ 5,620	49	7,016,198	7,584,766	—	568,568	Ord. Stk.	35	22	24	Nil
Buenos Ayres Western	1,930	8.6.35	52,972	+ 11,478	49	2,233,564	2,569,085	—	335,521	"	27½	18½	19	Nil
Central Argentine	3,700	8.6.35	124,676	+ 12,856	49	5,971,101	6,433,018	—	461,917	"	23	13½	14½	Nil
Do.	—	—	—	—	—	—	—	—	—	Dfd.	14	7	7	Nil
Cent. Uruguay of M. Video	273	8.6.35	10,659	+ 4,195	49	659,253	802,611	—	143,358	Ord. Stk.	15½	8	5½	Nil
Do. Eastern Extn.	311	8.6.35	1,748	+ 1,517	49	94,841	166,868	—	72,027	"	—	—	—	—
Do. Northern Extn.	185	8.6.35	1,488	+ 408	49	55,692	94,174	—	38,482	"	—	—	—	—
Do. Western Extn.	211	8.6.35	626	+ 487	49	36,494	75,609	—	39,115	"	—	—	—	—
Cordoba Central	1,218	8.6.35	30,310	+ 20	49	1,373,260	1,586,020	—	212,760	Ord. Inc.	6	3	2	Nil
Costa Rica	188	Apl., 1935	13,045	+ 1,659	43	162,371	181,164	—	18,793	Stk.	303½	23½	32	6¼
Dorada	70	Apl., 1935	10,700	+ 1,100	17	44,100	41,100	—	3,000	1 Mt. Db.	103	95	104½	5½
Entre Rios	810	1.6.35	11,195	+ 603	48	581,215	577,834	—	3,381	Ord. Stk.	21½	12	11	Nil
Great Western of Brazil	1,082	8.6.35	5,200	+ 1,100	23	196,200	190,700	—	5,500	Ord. Sh.	7½	5½	2	Nil
International of Cl. Amer.	794	Apl., 1935	\$455,976	+ \$12,489	17	\$1,763,588	\$1,991,549	—	\$227,961	"	—	—	—	—
Interoceanic of Mexico	—	—	—	—	—	—	—	—	—	1st Pref.	1/-	1/-	1/-	Nil
La Guaira & Caracas	223½	May, 1935	4,430	+ 1,255	21	19,930	17,555	—	2,375	Stk.	123½	7½	8½	Nil
Leopoldina	1,918	8.6.35	17,366	+ 306	23	497,538	484,241	—	13,297	Ord. Stk.	145½	7	5	Nil
Mexican	483	7.6.35	\$206,300	+ \$44,000	22	\$5,446,100	\$5,206,100	—	\$240,000	"	31½	1½	1½	Nil
Midland of Uruguay	319	May, 1935	6,298	+ 2,303	48	104,046	103,799	—	337	"	1½	1½	1½	Nil
Nitrate	401	31.5.35	3,792	+ 971	21	58,925	69,284	—	10,359	Ord. Sh.	32½	51/-	2½	Nil
Paraguay Central	274	8.6.35	\$1,581,000	+ \$537,000	49	\$58,340,000	\$36,923,000	—	\$21,417,000	Pr. Li. Stk.	84	67	60½	9½
Peruvian Corporation	1,059	May, 1935	71,815	+ 9,303	48	697,276	619,408	—	77,868	Pref.	14½	8	8	Nil
Salvador	100	1.6.35	221,750	+ 66,750	48	\$1,010,577	\$1,019,058	—	\$8,481	Pr. Li. Db.	75	70	65	7½
San Paulo	153½	2.6.35	26,688	+ 1,407	22	556,534	607,402	—	50,868	Ord. Stk.	86	67	57	4½
Taitai	164	May, 1935	2,680	+ 1,702	48	34,065	25,050	—	9,015	Ord. Sh.	2½	17½	1½	8
United of Havana	1,365	8.6.35	20,086	+ 4,283	49	1,139,107	938,023	—	201,084	Ord. Stk.	6	2	2½	Nil
Uruguay Northern	73	May, 1935	612	+ 436	48	11,338	12,555	—	1,217	Deb. Stk.	6½	3	4½	Nil
Canada.														
Canadian National	23,735	7.6.35	588,388	+ 20,077	22	13,874,331	13,724,725	—	149,606	—	—	—	—	—
Canadian Northern	—	—	—	—	—	—	—	—	—	Perp. Dbs.	78½	51½	57½	61½
Grand Trunk	—	—	—	—	—	—	—	—	—	4 p.c. Gar.	104½	97½	100½	31½
Canadian Pacific	17,211	7.6.35	457,600	+ 31,400	22	9,725,200	9,866,400	—	141,200	Ord. Stk.	189½	11½	11	Nil
India.														
Assam Bengal	1,329	10.5.35	31,410	+ 7,035	5	129,435	162,077	—	32,642	Ord. Stk.	88½	72	82½	3½
Barsi Light	202	20.5.35	3,788	+ 1,552	6	19,260	23,647	—	4,387	Ord. Sh.	104½	98½	35½	5½
Bengal & North Western	2,114	20.5.35	78,670	+ 4,932	6	380,949	405,944	—	24,995	Ord. Stk.	297½	262	298½	5½
Bengal Doonars & Extension	161	10.5.35	2,984	+ 359	5	12,139	13,319	—	1,180	"	125½	124	124½	5½
Bengal-Nagpur	3,268	30.4.35	184,425	+ 13,615	4	538,875	508,571	—	30,304	"	105½	96	101½	3½
Bombay, Baroda & Cl. India	3,072	31.5.35	267,925	+ 8,025	7	1,480,125	1,479,675	—	450	"	115	108½	114½	5½
Madras & South'n Mahratta	3,230	20.5.35	165,525	+ 25,613	6	786,450	896,341	—	109,891	"	131	122½	121½	7½
Rohilkund & Kumaon	572	20.5.35	13,890	+ 2,694	6	78,809	88,136	—	9,327	"	263	250	290½	5½
South India	2,526	30.4.35	111,505	+ 7,481	4	335,877	346,286	—	10,409	"	119	115	117½	61½
Various.														
Beira-Umtali	204	Mar., 1935	73,647	+ 24,140	26	378,782	290,974	—	87,808	—	—	—	—	—
Bilbao River & Cantabrian	15	May, 1935	1,493	+ 143	21	8,644	9,100	—	456	—	—	—	—	—
Egyptian Delta	622	20.5.35	4,907	+ 43	6	26,056	25,756	—	300	Pr. Sh.	213½	154	176	5½
Great Southern of Spain	104	1.6.35	1,888	+ 536	22	41,746	49,027	—	7,281	Inc. Deb.	4	3½	3½	Nil
Kenya & Uganda	1,625	Apr., 1935	222,462	+ 6,476	17	924,843	859,480	—	65,363	"	—	—	—	—
Manila	—	—	—	—	—	—	—	—	—	B. Deb.	50	33	44½	7½
Mashonaland	913	Mar., 1935	118,527	+ 29,656	26	687,786	530,604	—	157,182	1 Mg. Db.	101	91½	102½	4½
Midland of W. Australia	277	Apl., 1935	12,561	+ 735	43	134,787	134,040	—	747	Inc. Deb.	100	93	94½	5½
Nigerian	1,905	27.4.35	20,728	+ 4,279	4	108,287	109,530	—	1,233	"	—	—	—	—
Rhodesia	1,538	Mar., 1935	206,064	+ 52,199	26	1,137,061	908,456	—	228,605	4 p.c. Db.	104½	97½	104	31½
South African	13,217	13.5.35	534,861	+ 49,451	7	3,741,884	3,326,018	—	415,866	—	—	—	—	—
Victorian	6,172	Jan., 1935	834,838	+ 17,346	30	5,586,612	5,388,619	—	197,993	—	—	—	—	—
Zafra & Huelva	112	Apl., 1935	11,587	+ 1,622	17	44,550	44,641	—	91	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1½

† Receipts are calculated @ 1s. 6d. to the rupee. § ex dividend. Salvador and Paraguay Central receipts are in currency

The variation in sterling value of the Argentine paper peso has lately been so great that the method of converting the sterling weekly receipts at the par rate of exchange has proved misleading, the amount being overestimated. The statements from July 1 onwards are based on the current rate of exchange and not on the par value

# Diesel Railway Traction

## A Hundred Littorinas

AS with all innovations, a prime characteristic of diesel traction has been the way orders for one or two vehicles have kept dribbling through, with occasional spurts to five and ten. Constant success of the ones and twos led to the placing of larger orders in France and Germany in 1933-34, but only once hitherto (in December, 1934) have we had the pleasure of recording an order for a hundred, viz., the 100 Gardner-type engines ordered by the Belgian National Light Railways for installation in old petrol railcars and passenger cars. Recently, however, an order for a hundred diesel Littorinas has been placed by the Italian State Railways with the Fiat Company, and with the diesel Littorinas already in service, and described elsewhere in this issue, this new order will bring the Fiat design to the head of the table so far as the number of railcars of one design is concerned. The Fiat total is closely approached by the 250 b.h.p. Renault car as used on the six big French railways, but in this case there are certain variations in design, more particularly in the streamlined contour of the latest batch. One of the things which has made for the success of the Fiat diesel is the fact that the body, chassis and bogie designs have been thoroughly tried out on the numerous petrol Littorinas. The passenger design is being developed further into a car intended solely for parcels and light goods work, a type of operating unit which is in use already in Germany, France, Czechoslovakia, and Switzerland. Twelve further Littorina units with two 145 b.h.p. diesel engines running at 1,700 r.p.m. are now being constructed by Fiat for broad-gauge railways in Spain, and these vehicles will have a seating capacity of 92 and a top speed of 65 m.p.h. The high-speed streamlined articulated diesel-mechanical *de luxe* trains now being built for the Italian State Railways, and described in the *Diesel Railway Traction Supplement* for January 25, are of a modified Littorina design, and will have two 400 b.h.p. Fiat engines running at 1,500 r.p.m. and driving mechanical transmission.

## The Big Railway Oil Engine

ALTHOUGH in powers up to 300 b.h.p. the railway oil engine exists in hundreds, comparatively slow progress is being made in the four-figure sizes. This is due in part to the difficulty in constructing a reliable design which will go within the confines of the loading gauge and not exceed a reasonable weight. It is due also to the success of the steam locomotive in the range of high powers for long continuous runs, and despite the three or four schemes now under way for the introduction of diesel units of over 1,000 b.h.p. it will probably be a considerable time before oil-engine traction for heavy main line work becomes a serious rival to the steam locomotive except in countries with special problems. In this category comes India, where two British-built locomotives with 1,200 b.h.p. engines will be set to work soon on the Karachi-Lahore mail service. An engine of similar output has been installed in the Union Pacific streamlined train in place of the 900 b.h.p. unit fitted when it made the record Los Angeles to New York run. In this case

the engine is of the 16-cylinder V type whereas the British engine fitted to the Indian locomotives is of the straight-eight type. In Europe the P.L.M. has on order two 4,000 b.h.p. locomotives each with two 2,000 b.h.p. engines, and elsewhere in America, single engines of 1,800 and 2,000 b.h.p. are being fitted into heavy shunting and transfer freight locomotives. But for the 3,600 b.h.p. twin-unit locomotive just introduced on the Santa Fé Railroad for hauling a *de luxe* transcontinental train, four 900 b.h.p. engines have been used. If such a design was under consideration at the present time it is probable that two 1,800 b.h.p. engines would be favoured, and it is not beyond the bounds of possibility that within the next few years a single machine of 3,600 b.h.p. will be evolved, which will be suitable for use in North America at least, if not in Europe.

## The Diesel in the Emerald Isle

THE inauguration on June 1 of a diesel-worked suburban service out of Dublin brings up the number of diesel units in Ireland to a baker's dozen, and the normal daily diesel mileage to approximately 2,000. Apart from a 22-mile run with two stops between Dublin and Balbriggan, the latest diesel car of the G.N.R. (I.) builds up its daily mileage of 262 over the 8½ miles between Dublin and Howth with five intermediate stops. The normal schedule is 19 min., and the lie-over at Howth rarely exceeds 3 min. During the fortnight it has been in service the 102 b.h.p. twin car, weighing 29½ tons tare and 36 tons fully laden, has averaged 10 m.p.g. fuel consumption. Developed from the car introduced on the Bundoran line in November last, the top speed has been reduced to give greater accelerative power, and the clutch material has been changed and three adjustable clutch leverages provided to give easier operation and maintenance. The Bundoran car itself has covered 30,000 miles at a net operating cost (excluding the guard's wages) of about 2½d. per mile and with a fuel consumption of 14.9 m.p.g. These results have been so satisfactory that an extension of diesel traction on the Great North is contemplated. On the County Donegal Railways, the first line in Ireland to adopt diesel units, the operation of the Gardner-engined cars continues to be most satisfactory. Indeed, the engines themselves have been almost trouble-free, and the few features which have occurred have been associated more with the mechanical portion and clutch. The two six-wheeled vehicles set to work at the end of 1931 have each covered over 150,000 miles, and the first double-bogie car has made a mileage of 60,000 in its first year of service, these mileages being made in stop-anywhere service over sharply-curved lines with maximum grades of 1 in 50 for six miles. The economy effected by each of these small diesel cars is something well over £500 a year, and forms an excellent illustration of how oil-engined vehicles may assist (and in certain circumstances even save from bankruptcy) a small railway with light traffic over scattered lines. The possibilities of diesel traction in this direction have been proved not only in Ireland, but in Denmark, Germany, France and elsewhere.

## THE PROBLEM OF BIG-END BEARINGS IN DIESEL TRACTION

### *Experiences with high-speed engines of the Beardmore type*

By H. C. GILL

**T**HE advent of the high speed diesel engine for rail traction work some 10 years ago brought to light many new problems requiring solution, and one of the most troublesome related to big-end bearing failures. The type of bearing hitherto successfully employed for medium speed engines proved inadequate when adapted to units operating over a wide speed range and at high maximum revolutions accompanied by high unit pressures. In 1925 engines with 8½ in. by 12 in. cylinders, running at a maximum speed of 750 r.p.m., were employed for diesel-electric traction work, and it was in connection with these power units that big-end bearing failure first became prominent; its nature indicated a definite association with the higher duties imposed.

Intensive investigations were carried out for nearly three years, and at the end of 1929 a bearing was produced which gave the degree of satisfaction demanded by maintenance engineers. One of the difficulties with which the designers were faced was that of detecting any failure during bench trials, even when these were of an extended and arduous nature. It required lengthy running under actual service conditions to reveal the defects which ultimately resulted in complete collapse of the bearings. The main journal bearings gave comparatively little trouble, and it was obvious that a solution of the big-end bearing problem would also correct any tendency to weakness discovered in the former.

Essential particulars relating to the engines subjected to investigation between the years 1926-29 are tabulated below, and include figures for two later types designed to run at higher speeds.

No. of Cyls.	B.H.P.	R.P.M.	Piston Speed, Feet per min.	Big-End Bearings		Year Placed in Service
				Rubbing Speed, Feet per sec.	Press. lb./sq. in. Gas Load — (Inertia + C, Force)	
4	200	750	1,500	15.5	3,200	1925
8	400	750	1,500	15.5	3,200	1925
6	320	800	1,600	16.6	3,060	1927
12	1,330	800	1,600	26.1	2,280	1929
6	360	900	1,800	18.7	2,170	1930
6	225	1,200	1,800	21.0	1,700	1933

The failures connected with the four and eight cylinder engines led to modifications to the design of the bearings and connecting rods of the 320 and 1,330 b.h.p. units, although, as described hereafter, these played little or no part in effecting an improvement. The last two types listed were introduced subsequent to the solution of the problem, and it will be noted that these have higher piston speeds and corresponding higher rubbing speeds. The bearing pressures, on the other hand, are much lower to provide for a still greater margin of safety, and in particular to compensate for the increase in rubbing speed and thus keep the bearing load factor—which is a combination of speed and pressure—within reasonable limits. The 12-cylinder 1,330 b.h.p. engine is an exception in respect to the high rubbing speed employed, the large diameter of the cylinders arranged in V formation necessitating the use of a crankshaft of large dimensions.

In view of the success of the earlier types—once the bearing difficulty was solved and in spite of the high pres-

sures adopted—it may be suggested with some reason that a reduction of pressure is not justified, as this cannot easily be arranged without an increase of engine weight and length, objectionable features in railway work. Pressures of over 3,000 lb. per sq. in. may appear high, yet a large number of engines have been operating for many years at this figure and accomplishing an average of 100,000 miles without replacement of the bearings. There has been a tendency, however, to raise the revolutions in order to obtain more power and consequently a better power/weight ratio. This involves higher rubbing speeds and for safety the unit pressure has been reduced.

### Type of Bearing and Working Conditions

The four and eight cylinder engines were fitted originally with big-end bearings consisting of phosphor bronze shells lined with white metal 0.1 in. thick, anchorage grooves being provided in the shells to assist in retaining the metal. The shells were fairly light in section and as flexing was suspected to be one probable cause of failure, the 320 and 1,330 b.h.p. units were fitted with mild steel shells relatively much heavier in section. The increased rigidity of the bearings coupled with connecting rods of stiffer design resulted in no apparent improvement. It had, in the meantime, clearly been demonstrated that anchorage grooves were detrimental to proper adhesion of the white metal to the shell and these were ultimately discarded on all engines. The 320 b.h.p. units—which were of the same cylinder capacity as the four and eight cylinder engines—strange to say, gave even more trouble in service than the latter. At the time this was accounted for by the different working conditions, the six cylinder units operating over a much greater speed range. They were, moreover, designed to carry full torque from approximately 400 to 800 r.p.m., and although high torques were probably not applied in service at lower revolutions, it was thought the greater flexibility of the engines imposed higher average loads on the bearings. The eight cylinder engines operated at practically constant speed. The four cylinder units generally operated at maximum speed, together with short spells at moderate load at approximately 600 r.p.m.

Subsequent events proved that the different methods of operation had no influence on the bearing problem, and the performance is now equally good on all engines. The white metals employed were tin-base alloys and several of the best proprietary brands produced in this country were tried without success. The metal suppliers provided expert supervision of the metalling process and applied the latest known methods without avail. A baffling feature of the trouble experienced, was that many of these bearings gave first class service and were entirely free from defects after completing very large mileages. But one or more bearings in nearly every engine failed in time, some more or less rapidly, others after a reasonable period of service.

The defects took the form of small cracks which started in the crown of the bearing within an angle of approximately 40 deg. either side of the dead centre and were not confined to any particular point of this pressure area. They often commenced at or near the edge of the bearing at the fillet and were always associated with the top half shell, never the bottom half. In course of time the cracks spread until a large patch of white metal became

a mosaic of loose pieces which sometimes remained in position for long periods of running and dropped out of the shells when the bearings were removed for examination. These loose pieces invariably became detached in service and on occasion found their way into the crankpin oil-feed holes, interfering with the lubrication. The fragments gradually got beaten out until the white metal lining almost wholly disappeared, the shell backing making contact with the crank pin with disastrous results when steel shells were employed. The collapse of the bearings had no connection with lubrication in so far as this relates to oil failure.

Investigations as to the cause of failure were directed to the exploration of every possible avenue connected with the problem. Detailed monthly reports compiled by the maintenance engineers covering a period of three years were available for study, and extensive experimental work undertaken by the engine designers and railway engineers was necessary before the trouble was located. A suspicion that the unit pressures were too high for arduous railway service was disturbing, but evidence that many of the bearings proved satisfactory over long periods discounted this. Part of the research work was carried out on an engine specially constructed for the purpose, this being a single cylinder unit provided with means for electrically recording the temperature of the crankpin surface at a large number of points around the periphery.

#### The Cause of the Trouble

The trouble was ultimately found to be caused by imperfect bonding of the white metal with the shell. This had long been considered as the probable explanation, but how to obtain a consistent and perfect bond in bearing production was another matter. The chief credit for finding a solution lies with the maintenance engineers of the Canadian National Railways, who, together with Mr. Roast, a Montreal metallurgist, developed a bearing which, if properly produced, ensures entire freedom from the trouble which had persisted for so long. This consists of a special lead-base alloy, applied—for the best results—to a lead-bronze shell backing; bronze with a phosphorus content is unsuitable. The successful production of this type of bearing lies not only in the scrupulous cleanliness observed during manufacture, but more particularly in the close control of the temperatures of the jigs, tinning bath, and white metal during the metallizing process. The compositions of the alloys are given in the accompanying table.

Analysis of White Metal		Analysis of Lead Bronze	
Copper ..	1.00 per cent.	Copper ..	77 per cent.
Lead ..	78.75 "	Lead ..	15 "
Tin ..	1.25 "	Tin ..	8 "
Antimony ..	18.00 "		
Arsenic ..	1.00 "		

The tinning bath is composed of 70 per cent. tin and 30 per cent. lead solder maintained at a temperature of 600-650° F. A solid type jig is employed in order to retain the heat and this is kept at a temperature of 250-300° F. The white metal is heated to 1,050° F. and poured from a ladle previously raised to the same temperature, the ladle being large enough to complete the pour in one operation. The shell is removed from the jig when the temperature has fallen to approximately 200-250° F.

During the tinning process the shell is completely immersed in the bath and left until it has fully reached the temperature of the solder, being removed three or four times to coat the surface with a flux of muriatic acid and zinc. This, briefly, is the procedure observed during the metallizing process, accompanied by a number of simple but important operations to ensure that the various stages are performed with accuracy and thoroughness.

Bearings from 4 to 5 in. dia. are poured with a white metal thickness of approximately  $\frac{1}{2}$  in., the finished thick-

ness after final machining being only  $\frac{1}{8}$  to  $\frac{1}{16}$  in. When subjected to a chipping test there is no tendency for the white metal to peel away from the shell, a perfect bond existing between the two metals. One or two from every batch are usually given a chipping test and part of the inspection consists in immersing the shells prior to final machining, in an oil bath at a temperature of approximately 180° F. After the oil is wiped off, the bearing surface is dusted with powdered French chalk and any minute cracks or flaws are clearly visible.

Originally it was the practice to metal the shells on end in a vertical position but improved results are now obtained by carrying out this operation with these laid on their backs horizontally, and pouring at one side. There is

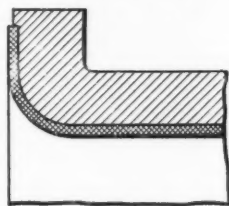


Fig. 1a

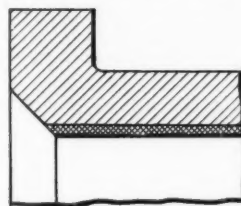


Fig. 1b

an entire absence of anchorage grooves in the shells, as it was long ago established that these only formed air traps which together with sharp corners, defeat the very object for which they were introduced. Where possible, it is preferable to avoid carrying the white metal around the bearing fillets at the ends as in Fig. 1a. It is found with this construction that a little difficulty sometimes exists in obtaining a satisfactory bond at this point. A better arrangement is that shown in Fig. 1b but while this is suitable for big-end bearings it is often necessary to adopt the practice indicated in Fig. 1a in the case of main journal bearings where these take end thrust.

Provided the design of the bearing shells and connecting rod is reasonably rigid, no useful purpose is served in making these parts superlatively stiff. It has been demonstrated that comparatively light bearings and rods give as good service as those much stiffer in design. It is noteworthy that, when lack of stiffness was considered to be a contributory cause, a group of engines, fitted with rigid bearings and rods, gave just as much trouble as the units equipped with the more flexible type.

The cost of the white metal now employed is low compared with that of tin base alloys, and bearing production is therefore economical. The alloy can be used successfully with crankshafts of low tensile steel or alloy steels of high tonnage. Records covering extended periods show that the wearing life of a crankshaft manufactured of low tonnage steel is apparently as good as that of a nickel chrome steel shaft of high tonnage. The tendency nevertheless is to employ alloy steel shafts of fairly high strength in order to obtain reasonable surface hardness.

Respecting tin base alloys, whatever developments may have taken place in recent years regarding their application, it is doubtful if they can compete with the special lead base alloy described. Mr. R. G. Gage, in an article on the operation of the Canadian National cars contributed to this Supplement for August 10, 1934, stated that it was a careful analysis of the babbling process which led to a solution of the difficulty. It might be inferred from this that the process originally was not carried out with sufficient care, but reflection on the skilled attention provided by the engine makers and metal suppliers leads one to believe that some inherent difficulty exists in connection with tin base alloys, making proper bonding uncertain.

# AIR RESISTANCE OF THE BURLINGTON ZEPHYR

*A précis of the test results obtained from a wind tunnel*

By

SHATSWELL OBER

Associate Professor of Aeronautics,

Massachusetts Institute

of Technology

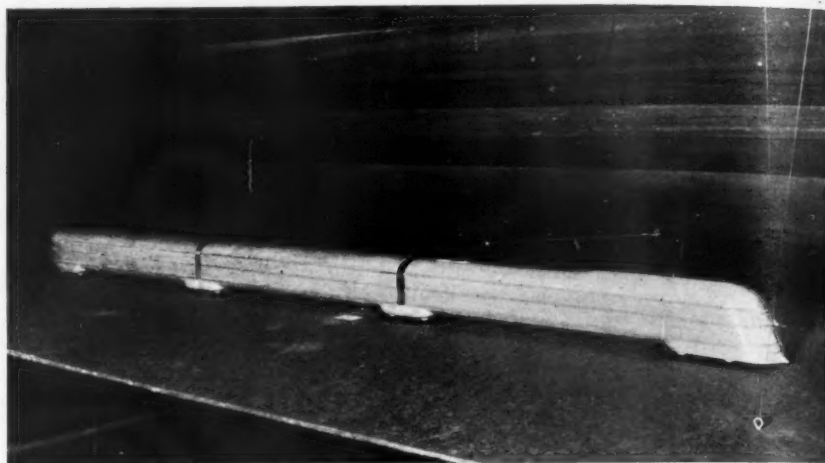


Fig. 1—Model of the Burlington Zephyr in the wind tunnel at the Massachusetts Institute of Technology

THE external form of the Burlington Zephyr has been made as smooth as practicable to minimise air resistance. The front is rounded, the rear slightly tapered, and all structural members and apparatus below the cars are enclosed in a rounded bottom. Within the limits imposed by utility it is streamlined. The effect, in combination with the highly polished stainless steel side covering, is to make a strikingly handsome train.

During the development of the design, the Edward G. Budd Manufacturing Company needed to know the air resistance for estimating performance. A model of the Zephyr and a model of a corresponding conventional three-car petrol-driven train (included for comparison) were therefore made and tested in the wind tunnel at the Massachusetts Institute of Technology.

The tunnel used for these tests is a large Venturi-like tube, 5 ft. in diameter at the throat, where the model is mounted for test. Through this tube air is drawn by a four-bladed propeller type fan, driven by a 75 h.p. electric motor. The speed of the air is varied by controlling the revolutions per minute of the motor by the Ward-Leonard system. The return flow of the air to the mouth of the tunnel is through the open room. For these tests the model was held by wires close to a smooth fibre board, Fig. 1. The purpose of this board is to represent the ground. This it does, but somewhat approximately, as the board and train model are fixed, with the air flowing by them, while the ground and air should be fixed with the train moving by. The relative velocity of train and air is correct, but not that of wind and ground. If the ground were not present the flow lines of the air below the model would not be like those between train and ground. It was not thought necessary to represent the track. The presence of the board reduced the measured resistance of the Zephyr model by 10 per cent.

The models were tested parallel to the airstream corresponding to travelling through still air, and also at an angle to the air-stream as if travelling through a wind blowing across the track. For the first tests, the models were held by wires; for the second series, they were mounted on a rod supported by the regular air-foil testing

wire balances. The model of the Zephyr was  $\frac{1}{40}$  scale, about 60 in. long. All tests were made at a wind speed of 60 m.p.h. It must be remembered that this is the relative wind speed—for the real train the combination of the speed along the rails and the wind which may be blowing, not the speed along the track except when there

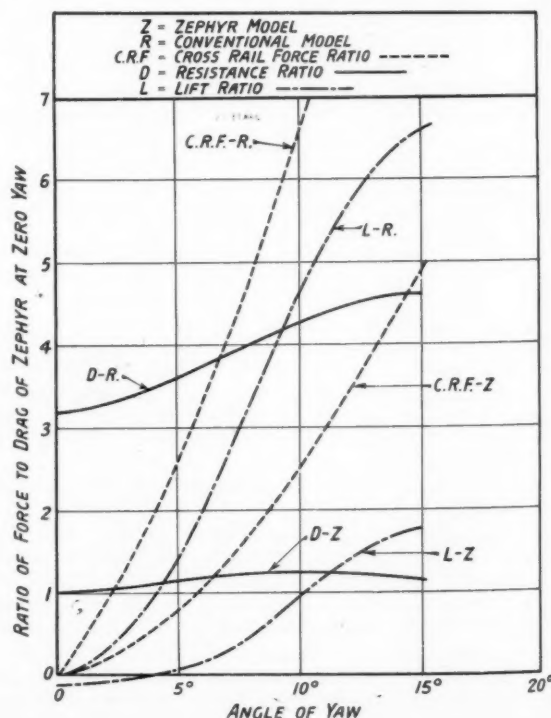


Fig. 2—Aerodynamic forces on train models of normal and streamlined shapes



A striking view of one of the new Zephyrs now running between Chicago and the Twin Cities

is no wind. The following forces were determined; the resistance, meaning the force along the rails; the cross rail force; and the lift.

It is convenient to express the resistance force on the Zephyr model parallel to the wind as a coefficient:—

$$D = \text{Resistance} = D_e AV^2$$

in which A is the cross sectional area in sq. ft.;

V is the relative wind in m.p.h.;

D is the resistance in lb. when the air density is 0.00238 slugs per cu. ft.

$D_e$  is 0.00100.

This coefficient may be used in estimating full scale resistance closely, as, though there were of necessity minor parts omitted from the model, the surface frictional resistance coefficient would be less full scale. All other forces will be given as ratios of that basic force, and may be found in Fig. 2. Translated, the air resistance force of the Zephyr requires 290 h.p. on the rail at 100 m.p.h., while the regular train would require over 900. The rolling resistance at that speed requires about 230 h.p.

It will be noticed that both the side force, which leads to an overturning moment, and the lift force are larger on the conventional model than on the streamlined model. At 80 m.p.h. an angle of 15 deg. means  $21\frac{1}{2}$  m.p.h. cross track wind, and the side force would be 3,200 lb., and the lift 1,300 lb. The air resistance first increases with side angle then drops off (the side force acting like a sail on a yacht). The side force will cause an increase in rolling resistance. Test results on the Zephyr indicate that the air resistance coefficient found by these tests gives very closely the correct full scale resistance. The presentation of this description of the wind tunnel tests is made possible by the courtesy of the Edward G. Budd Manufacturing Company.

## FRENCH RAILCAR PRACTICE

### *Some first-hand notes on recent performances*

(By a Correspondent)

**D**URING a leisurely journey through France and back, the following characteristics of French diesel railcar working were noted. Renault diesel car No. ZZ724053, on the Etat line from Le Mans to Alencon, ran very smoothly but noisily at 115-118 km.p.h. (71-73 m.p.h.). This vehicle has a standing capacity of 28 and seats 42 passengers, all one class. It covered the 56 km. in 43 min. 47 sec. including two stops (of but 24 and 14 seconds' duration), and a long slowing over the last eight km. to avoid premature arrival. (At the time of writing the schedule was 45 min.) Although these cars are admirably suited for services of this nature, and are very popular for journeys of this and of the 2-hr. Paris-Havre length runs, they have serious drawbacks for long-distance running. The buffet facilities are decidedly limited, if they exist at all; difficulties arise regarding ventilation; movement is restricted, the seats are too rigid, and luggage and lavatory accommodation are not all they might be.

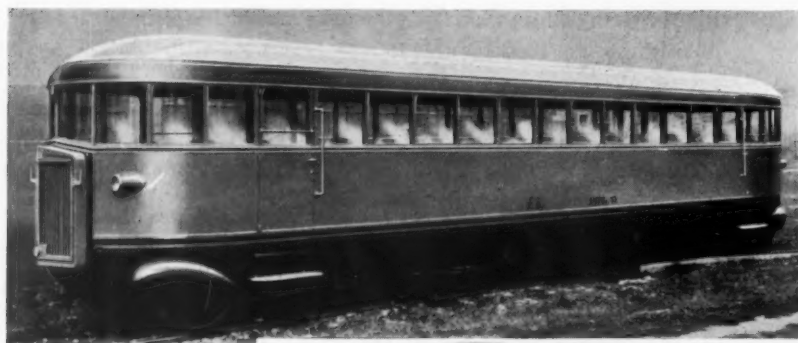
True, some of these troubles are avoided in the P.L.M. twin Bugatti; nevertheless, it would appear that the streamlined set is better suited for long main-line runs at high speeds, and that despite the additional cost involved, railcars should always be capable of hauling a trailer. This avoids the overcrowding and possible refusal of passengers so frequently met on the P.L.M. and Nord railways. This theory is borne out by a journey on a railcar operating on State lines between St. Pierre des Corps, Poitiers and Rochefort (incidentally

giving the fastest services between Paris and La Rochelle, i.e., 5 hr. 57 min. and 5 hr. 43 min.) The car left St. Pierre des Corps at 11.5 a.m., after having picked up 29 of its 35 passengers from the 8.25 a.m. from Paris. Through travellers had no opportunity at all of obtaining refreshments until La Rochelle was reached at 2.22 p.m. The vehicle in question was a Renault, similar in type and accommodation to the Le Mans-Alencon car. It works only one double trip a day from Rochefort to St. Pierre des Corps and back; another similar vehicle assures the evening run Rochefort-Poitiers, and connects with the 5.15 p.m. Bordeaux to Paris train. These particular workings are probably the best examples of railcar practice in France today for long-distance, cross-country work. The schedule from St. Pierre des Corps to Poitiers (withdrawn since May 15, owing to the running of a new railcar service from Tours to Port de Piles), including stops at Port de Piles and Chatellerault, is only 74 minutes. A smart get-away was made from St. Pierre, and Villeperdue was reached in  $15\frac{1}{4}$  min. (as compared with the 19-20 min. usually taken by steam trains). The schedule was further improved upon without exceeding 105 km.p.h., despite long easings to avoid early arrivals.

At Bordeaux a luxuriously carpeted and curtained Etat Renault (No. ZZy24054) was noticed. This vehicle was fitted with 46 movable chairs, two on each side of the centre gangway instead of the fixed seating for two and three passengers on each side, which is the usual practice.

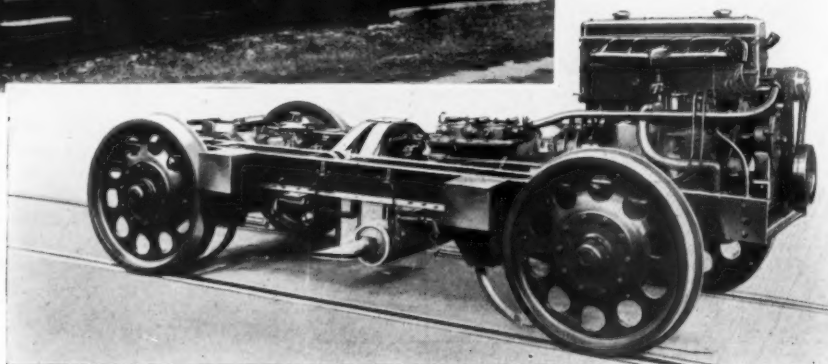
## A DIESEL MODEL OF ITALIAN STANDARD PETROL CAR

*On order are 112 Littorinas—with a difference*



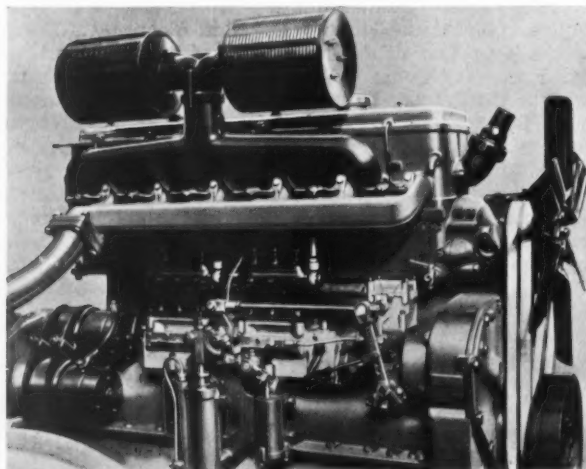
*General view of the  
Littorina railcar as built  
by the Fiat company*

*Engine and trans-  
mission mounted on  
power bogie of a  
standard-gauge Italian  
Littorina*



AS long ago as August 4, 1933, a description of the Littorina petrol-driven railcars of the Italian State Railways was given in THE RAILWAY GAZETTE. The builder of these vehicles, Fiat, has recently delivered ten more railcars of outwardly similar appearance, but driven by diesel engines, and an order for no fewer than 100 double-engine diesel units of 160 b.h.p. has been placed by the Italian State Railways, and an order for 12 290 b.h.p. cars by two Spanish railways.

Designed for the 4 ft. 8½ in. gauge and capable of a maximum speed of 68 m.p.h. on the level, this new type of railcar has a seating capacity of 56, and is divided into two passenger compartments, separated by a smaller central one for luggage and lavatory accommodation.

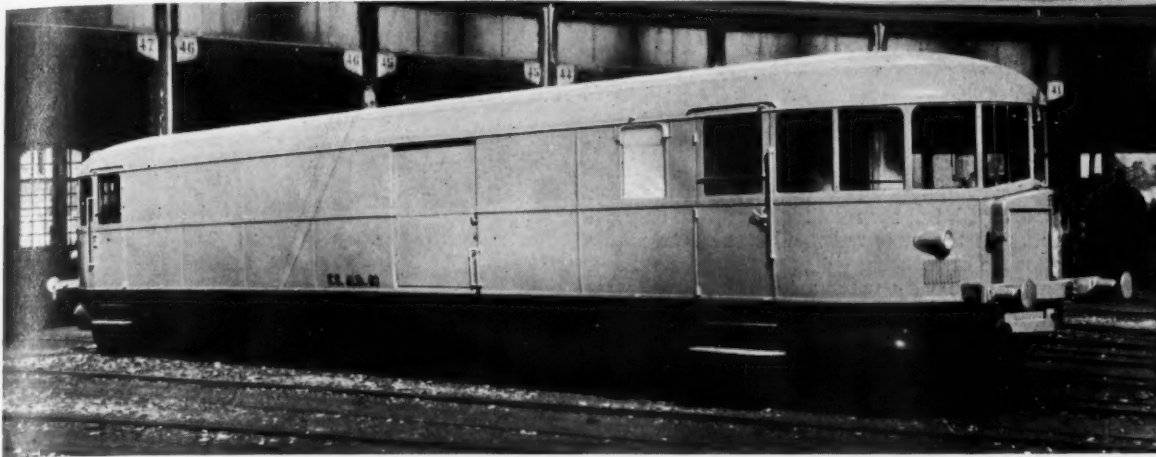


*Fiat six-cylinder 75 b.h.p. diesel engine*

One of the main compartments has 16 double seats and the other 12; in the rush hour standing room is afforded on the respective platforms. The overall length and width of the body are 57 ft. 9 in. and 7 ft. 10½ in. respectively. The car stands 10 ft. 3½ in. above rail level, and has wheels with a diameter of 3 ft. The vehicle weighs 19 tons 12 cwt. when empty, and 26 tons 7 cwt. with passengers aboard. Its seats are spring upholstered in red velvet; all the windows can be opened and are fitted with safety glass and roller blinds. The end windows on the platforms are fixed, with the exception of the one alongside the driver; this one can be lowered and is provided with a small vertical windscreen on its front side. There are two doors in each vestibule, their movements being governed by electrically-controlled safety closing mechanism and checked by warning lamps on the driver's desk. A driving compartment is provided at each end of the car, fitted with an adjustable seat and all necessary control levers and instruments for the proper working of the vehicle.

Power is supplied by a six-cylinder four-stroke Fiat engine, capable of developing 75 b.h.p. at 1,600 r.p.m. The cylinders are of 108 mm. bore and 152 mm. stroke. They are cast en bloc, are fitted with centrifugally cast iron liners and have detachable heads to carry the valves and the fuel injector. The camshaft, situated in the crankcase, is driven by an adjustable silent chain, which also drives the speed governor and fuel injection pump. The crankshaft is made of chrome-nickel steel; it is accurately balanced and fitted with a torsional vibration damper. Four gearbox steps are provided, giving respectively ratios of 4.55, 2.82, 1.65 and 1.0 to 1 for the first to fourth positions. The final reverse drive ratio is 2.44 to 1.

The fuel is fed by an injection pump connected to the injector on each cylinder. It is conveyed to the pump by two electric diaphragm pumps, working either separately



*One of the Fiat Littorina parcel vans on the Italian State Railways*

or in parallel, as desired, and drawing from the fuel tanks, each of which contains 32 gal., sufficient for a run of about 670 miles. On an average, 1-16 lb. of fuel are consumed per mile. The throttle is controlled by a pedal acting through a pneumatic cylinder on to the centrifugal governor, which in turn alters the stroke of the regulating rod of the injection pump.

Forced lubrication is ensured by a high-capacity gear pump. A double external filter with a pressure regulating valve and a safety valve are included in the oil piping circuit, and a centrifugal pump circulates the cooling water. There is also a thermostat regulator fitted in the pipe line. A radiator at each end of the vehicle ensures efficient cooling whichever way the car may be travelling. The engine is readily accessible for inspection by opening up the bonnet vertically. Several layers of sound deadening material line the latter part.

Substantially akin to those of other models, the transmission consists of a friction clutch of the multi-plate type (easily adjustable from outside), a four-speed gearbox, a free-wheel device, reversing gear and reduction gear lubricated by a pump inside the axle casing and working in either direction. Compressed air supplied by

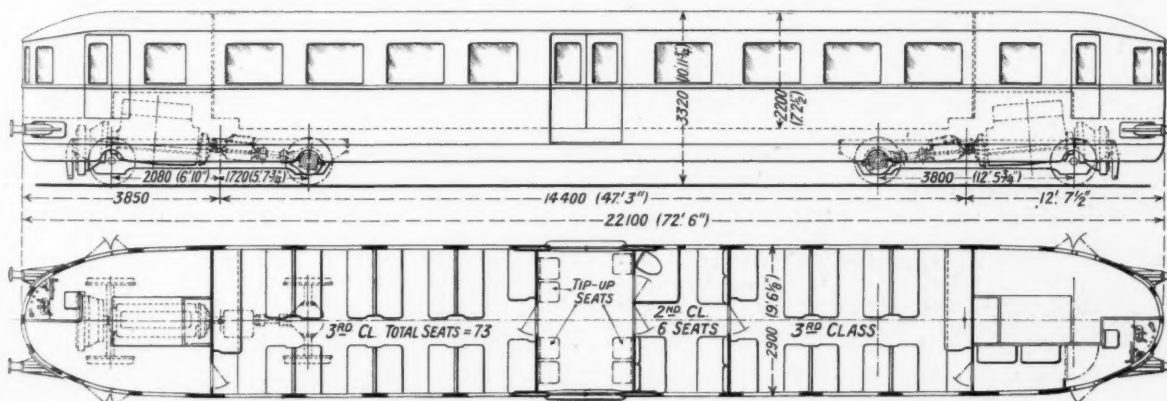
a two-cylinder compressor mounted on the side of each gearbox and driven by the layshaft operates the throttle, clutch, gearbox, freewheel and reversing gear. The brakes are not operated by a pedal, as in previous models, but by a handle on the driver's desk, a separate reservoir supplying the necessary compressed air.

The two bogies each carry an engine with gearbox, driving axle and transmission shaft. One pair of wheels on each bogie is driven. The transmission is planned to be readily accessible, both when the bogies are detached from the car—an easy operation when the body is lifted—and when they are in service position. To this end all grease cups are located at the ends of the bogies, where they may easily be reached by the grease gun. The axles are of nickel-chrome steel, and mounted on large roller bearings. The internal-expanding brakes work on large diameter drums, and are actuated by both compressed air and by hand through a system of levers and pull rods. These vehicles are warmed by passing the exhaust gases through gilled pipes around which air circulates before being admitted to the car through adjustable vents beneath the seats. The Italian State Railways has some Littorina rail vans for light goods and parcel traffic only.

## FAST DIESELS FOR ROUMANIA

The Roumanian State Railways has ordered a number of double-engined diesel railcars to the design shown in the accompanying diagram. Each bogie is fitted with a 150 b.h.p. M.A.N. lightweight engine driving the inner

axle through Mylius mechanical transmission. These cars are intended for solo operation at speeds up to 80 m.p.h. Some of the cars have 6 second class and 73 third class seats, and others 8 second class and 72 third class.



## THE DRIVING POSITION IN DIESEL RAILCARS

By JURIJ L. KOFFMANN

CUSTOM has not yet staled the infinite variety of driving controls in railcars, whose number and layout differ radically not only when different transmission systems are employed, but even with kindred cars engaged in similar duties on the same railway. Some lines follow the sound principle of reducing the number of gauges and levers required to the very minimum. Other companies mount them round the cab with an apparent joyous abandon. The indiscriminate disposition of the controls makes movement difficult and hampers the driver in his duties. The value of few handles is especially apparent in cases of emergency stopping.

Electric transmission has achieved notable simplicity of control, but with the recent introduction of highly efficient five-speed gearboxes in outputs up to 450 b.h.p mechanical transmission can hardly be said to suffer from complication.

The first 80 b.h.p. railcars on the Netherlands Railways\* have a somewhat complicated control position for a small vehicle (as may be seen from the first of the accompanying illustrations), on account of the electrical switchboard and various meters, including the engine revolution counter, speedometer and air brake gauge on the right, and the cooling water thermometer on the left, which fitting may be converted to an alarm signal actuated only should the temperature rise beyond a predetermined limit. A further gauge on the driver's desk shows the air pressure in the gear and clutch operating cylinder, while, reading from left to right, the handles are: reverser, accelerator control, air supply valve (for gear control), combined gear selecting and clutch control, air gong valve, and air brake. The compartment looks overcrowded, this effect being heightened by the comparative smallness of the cab and the lack of a seat—the provision of which would



*A rather complicated driving position in the old 80 b.h.p. railcars of the Netherlands Railways*

\* These were the first vehicles to have the Mylius transmission, described in the *Diesel Railway Traction Supplement*, January 25.—Ed., R.G.



*Driving position of diesel railcar on the Karlskrona Railway*

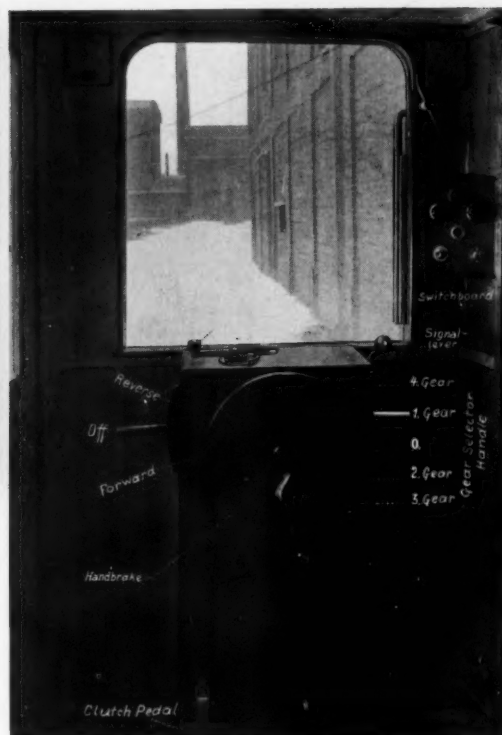
considerably lessen fatigue of the driver and render him more efficient. There is no reason to assume that a seated driver would act less quickly than one standing, or that his powers of observation and reaction to emergency would be impaired. It has been suggested that the number of accidents would increase should he be sitting, and that he might drowse in the warm atmosphere of an enclosed cab, but facts disprove both assertions. The final choice of position would naturally be left to the driver's own inclination.

A very roomy driving stand is provided on the four-wheeled car of the Karlskrona Wexiö Jernväg, of Karlskrona, Sweden, which is powered by two 100 b.h.p. engines. The few essential meters are located under the switchboard on the front wall and the controls have been limited to reversing, accelerating, gear selecting, clutch controlling and air braking handles. A hand brake lever and air gong valve and foot-operated sanding pedal are also provided. The driver's seat is of a primitive, inconvenient design, and a higher degree of comfort might well be given. Another idea, tending to

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Above: Omnibus-type of driving position of the 95 b.h.p. car with Mylius geared transmission on the Lüneburg-Soltau Railway



Right: Simple driving controls of 70 b.h.p. narrow-gauge diesel-mechanical railcar on a Polish light railway

increase efficiency on a shift lasting some hours, is to raise the seat to about 34 in. above floor level, this being the height at which the driver's head is at the same level as when he is standing. The distance between the body and the control handles would be exactly the same, and by obviating any difference between the two postures, in cases of accident no driver could shelter behind the excuse that the seated driving position felt strange to him. The foot-applied controls, such as the sander, whistle, and brake, can be fitted with elevated foot rests to suit the raised driving position, thus saving the driver from the discomfort of dangling legs and pins-and-needles in the feet.

The provision of an air brake handle arranged for operation in the vertical instead of in the horizontal plane would add to the convenience of the driver, thus ensuring a quick and shockless application, as well as a more rapid action in case of emergency.

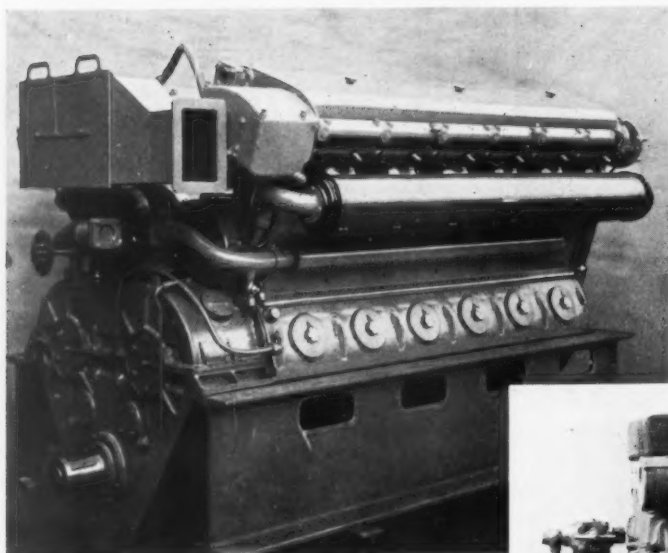
Some railways favour the automotive type of stand in railcars on account of the small space occupied. This factor is especially important with secondary lines, where every available inch must be utilised for passenger accommodation in order to permit successful operation in the face of ever-increasing road competition. A typical stand of this type is that provided on the four-wheeled 95 b.h.p. railcar recently placed in service by the Lüneburg-Soltau Railway, of Lüneburg, Germany, which has a maximum speed of about 37 m.p.h. on the level. Here the accelerator lever is placed on a column at the driver's left, while the gear selecting and reverser handles are on the right. The clutch is pedal operated. The control instruments and electrical switches are conveniently disposed on the dashboard, while brake and sander are applied by foot. A hand brake is also fitted to hold the car at terminals. This type of car needs a much more comfortable seat than the simple, bicycle saddle type in general use, as with foot control a really adequate back support is essential.

It seems unnecessary to provide drivers of light railcars, running at moderate speeds and making frequent stops on

secondary lines, with a separate compartment, as the space occupied could be better employed as passenger accommodation. One might also dispense with the rear curtain in favour of a better view from the front of the car, and gain more efficient car handling thereby. The curtain could be eliminated by placing the frontal glass at an angle of 15 to 20 deg. This angle is ample to obviate glare, and is actually more convenient to the driver when snow or rain is falling. A window wiper, air or electric operated, is considered almost a *sine qua non* in modern practice, but most types at present in use do not clean a sufficiently large area. The provision of heaters in the equipment enclosure immediately under the front window would also be advantageous. With slotted openings fitted in the top of this enclosure, and screens in the low front, a current of warm air is automatically created and flows along the front glass, preventing frosting over or freezing during cold spells. Some difficulty has been experienced in providing an effective, simple, and yet pleasing arrangement for the controls and instrument panel of the unoccupied stand. Usually steel or wooden box-shaped covers are used for this purpose, but a wooden roller curtain is used on the Lüneburg-Soltau car, and seems to provide a happy solution.

One of the simplest driving stands yet built is that of the 70 b.h.p. double-bogie car working on the Dyrekcja Gnieznienskiej Kolei Powiatowej, at Gniezno in Poland. This unit, which runs up to about 30 m.p.h., has a pedal-operated clutch and gear, as there is no air supply. The alarm signal is actuated by a push-and-pull lever, while the arrangement of the other control levers, as well as their simplicity, speaks for itself. This type of stand is especially suitable for secondary line working by native drivers, under which conditions a highly competent staff and well equipped shops are generally conspicuous by their absence. For railcars used in tropical countries, and even in European latitudes, a sun shield fitted over the top of front windows of the driving cab is indispensable, and it provides also some protection from winter snow.

## GERMAN LIGHTWEIGHT RAILWAY DIESELS

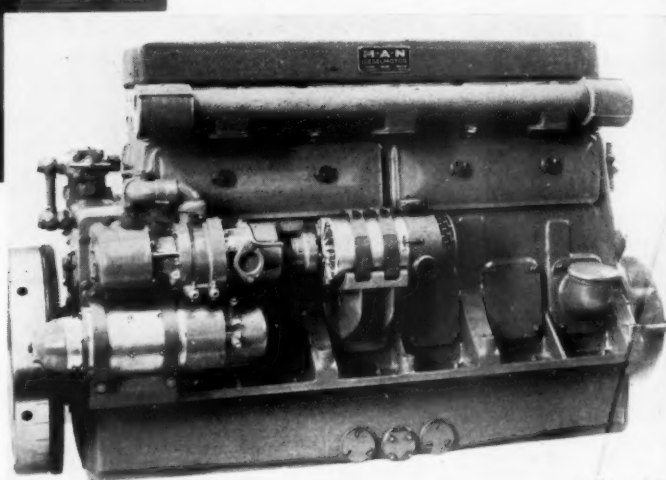


**A**MONG the high-speed engines now being manufactured by the Maschinenfabrik Augsburg-Nürnberg for the railway field are units varying from 90 to 450 b.h.p., and three of the most widely used types are shown in accompanying illustrations.

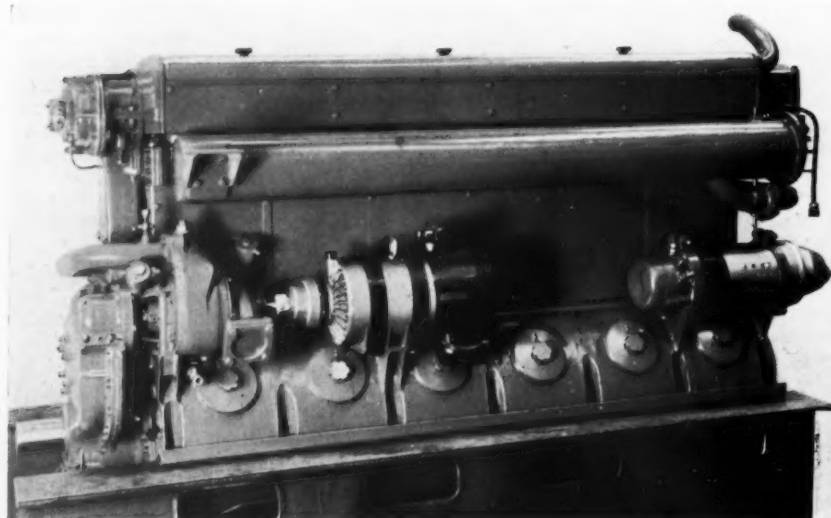
The most interesting model is the 12-cylinder four-stroke V engine which develops a continuous output of 420 b.h.p. at 1,400 r.p.m. and has a short-time rating of 450 b.h.p. at 1,500 r.p.m. The cylinders are 7.09 in. bore by 8.4 in. stroke, and the engine weight is 6,950 lb., corresponding to 16.5 lb. per b.h.p. on the continuous rating. Features of the construction are that the crankcase and cylinder block are fabricated of welded steel, that each cylinder bank has a crankshaft of its own,

these two shafts being geared to a single output shaft. Thirty-five engines of this type are running in Reichsbahn diesel railcars and four further units supercharged up to 560/600 b.h.p. are in course of delivery.

Welded framing is incorporated also in the six-cylinder 210 b.h.p. engine, but cast iron is used for the 150 b.h.p. model. In the 210 b.h.p. size, the rated output is developed at 1,400 r.p.m. in six cylinders 7.09 in. by 8.4 in., these six cylinders being the same, *mutatis mutandis*, as one bank of the 420 b.h.p. V engine. The maximum capacity is 225 b.h.p. at 1,500 r.p.m. On the normal rating the weight is equivalent to 15.6 lb. per b.h.p.,



whereas the 150 b.h.p. unit, with cast iron framing, scales 19.6 lb. per b.h.p. This latter model has six cylinders with a bore of 5.91 in. and a stroke of 7.09 in., the rated power is 150 b.h.p. at 1,500 r.p.m.



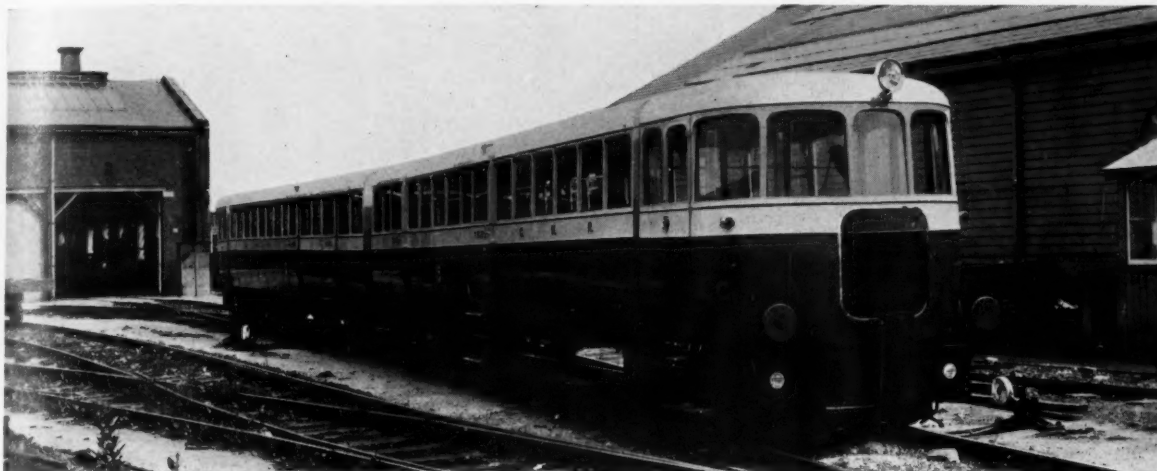
Top: General view of M.A.N. 12-cylinder 420 b.h.p. railway diesel engine with twin crankshafts

Centre: 150 b.h.p. quick-running railcar engine; the illustration shows the electric starting motor, cooling water pump, and air filter

Bottom: 210 b.h.p. six-cylinder lightweight railcar engine with welded steel framing

## THE GREAT NORTH GETS ANOTHER

*Heavy suburban service in and out of Dublin worked by twin diesel car*



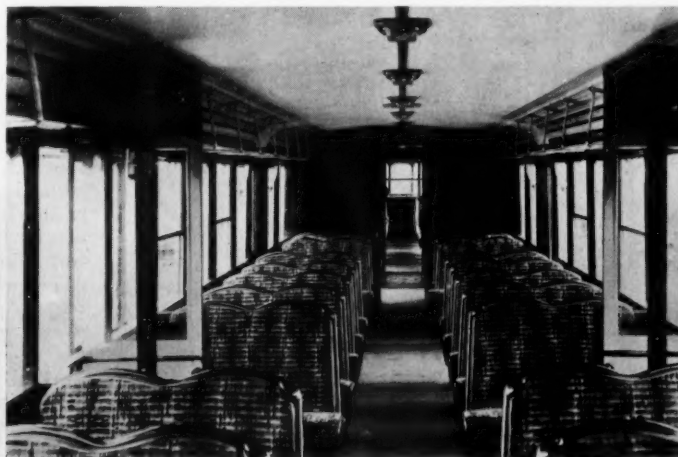
*New twin-unit diesel-mechanical railcar on the Great Northern Railway of Ireland*

**F**OLLOWING the success of the 96 b.h.p. car on the Bundoran branch (see *Diesel Railway Traction Supplement*, November 30, 1934) the Great Northern Railway of Ireland has introduced on the Dublin-Howth line a twin unit consisting of two similar cars coupled back to back. The main differences are the provision of three classes of seats in place of one; the raising of the engine power from 96 to 102 b.h.p. by increasing the speed from 1,600 to 1,700 r.p.m.; and the reduction in the top road speed from 45 to 36 m.p.h., largely to give greater acceleration.

Through the kindness of Mr. J. B. Stephens, General Manager, and Mr. G. B. Howden, Chief Engineer (under whose direction the unit was built), we have inspected the new car in operation. A main requirement of the specification was that the car should be capable of being worked as two separate units if desired, and therefore each half has its own Gardner engine; only one of these actually drives when in service, alternate engines being used on

the in and out trips. Apart from the mechanical coupling and passenger vestibule, the only connections between the two halves are the vacuum brake and heater pipes, and the cable for paralleling the two Exide batteries.

The bodies and chassis were built at the G.N.R. works at Dundalk, and the accommodation comprises 6 first, 32 second, and 60 third class seats, the first class seats being Pell's tub chairs clamped to the floor. The second and third class seats are of Laycock manufacture and all are covered in Holdsworth's upholstery. The windows in one car are of Beclawat type and in the other of Hallam, Sleigh and Cheston make. The power unit and bogie was built by Walker Bros. (Wigan) Ltd., and runs on Timken roller bearings. The four-speed gearbox gives maximum road speeds of 10½, 15½, 26½, and 36 m.p.h. The trailing bogie is of light build, and runs on Hoffmann roller bearings. A normal daily mileage of 262 is made between Dublin, Howth, and Balbriggan.



*Exterior and interior of diesel railcar for Dublin suburban traffic*

## NEW STANDARD-GAUGE SHUNTERS IN FRANCE

*Mechanical transmission with electric control used for heavy-duty units*



*One of the four 240 b.h.p. diesel-mechanical shunting locomotives of the C. de fer du Nord*

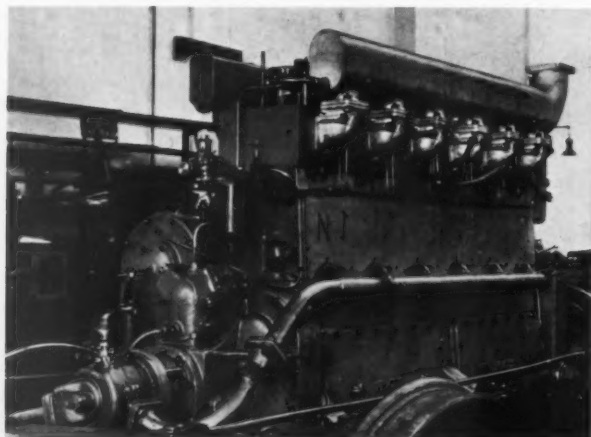
THE rapid extension of diesel traction on the C. de fer du Nord, has received another fillip by the completion of four 240 b.h.p. shunting locomotives. Built by Les Ets. Baudet, Donon et Roussel to the requirements of M. Lancrenon, Ingénieur en Chef du Matériel et de la Traction of the Nord, these units are noteworthy by reason of the incorporation of mechanical transmission electrically-controlled on the Cotal principle, and also by reason of the fact that they are the first diesel units in France to be powered by the Frichs type of engine, built by Corpet-Louvet et Cie, the Frichs' licensee.

As may be seen from the accompanying illustrations the locomotives are of the four-wheeled type with a centre cab containing duplicate sets of controls for convenience in shunting. The 1.05 m. (41.4 in.) wheels are spread over a base of 3.54 m. (11 ft. 7 in.) and are braked by the Westinghouse and hand systems actuating two blocks on each wheel. Air from the former is used to operate the sanding gear and the whistle. Electric lighting of the cab

and electric starting of the engine are effected with current obtained from a cadmium-nickel battery. The maximum tractive effort is 12,000 kg. (26,500 lb) and compared with the full working order weight of 35 tonnes (34.5 tons) this gives an adhesion factor of only 2.91, a very low value. A maximum trailing load of 1,200 tonnes (1,180 tons) can be hauled on the level at a speed of 5 km.p.h. (3.1 m.p.h.), and the top speed running light or with a small load is 60 km.p.h. (37.3 m.p.h.). The length over buffers is 8.92 m. (29 ft. 2 in.) the width over the cab 2.8 m. (9 ft. 2 in.) and the height to the top of the cab 3.79 m. (12 ft. 5 in.). Standard French buffing and drawgear is fitted, and the locomotive is piped for the Westinghouse automatic brake for coupling to fitted vehicles.

The Corpet-Frichs engine develops a continuous output of 220 b.h.p. at 1,000 r.p.m. and a maximum output of 240 b.h.p. at the same speed. It is one of Frichs new high-speed light weight range and weighs 16 lb. per b.h.p. on the continuous rating. The six cylinders have a bore of 175 mm. (6.9 in.) and a stroke of 260 mm. (10.2 in.), and these dimensions result in a m.e.p. of 82.8 lb. per sq. in. and a piston speed of 1,710 ft. per min. The cast steel cylinder block contains cast iron liners, and is mounted on a crankcase of aluminium-silicon alloys with inside strengthening ribs. The crankshaft main bearings are of white metal on a steel shell, whereas the big end bearings have white metal linings on a bronze backing. Heat-treated aluminium alloy is used for the pistons. The circulating water is passed through a fan-cooled radiator mounted on the front of the locomotive. The silencer is fitted on the cab roof, the eduction pipe leading thence from the engine bonnet.

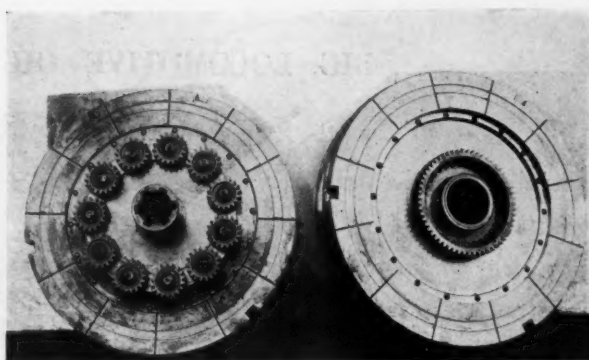
The engine torque, amounting to 1,150 lb.-ft. at normal output and 1,250 lb.-ft. at maximum load, is transmitted to the wheels through a Cotal epicyclic gearbox with electro-magnetic control. This type of box was described in detail in the issue of this Supplement for January 25, at the time it was introduced into this country by the Cotal Chadburn Co. Ltd. The weight of the complete gearbox is 550 lb. and two of the magnetic discs with attached sun and planet wheels are illustrated on next page. Installations in certain French railcars have proved that the wear



*240 b.h.p. Frichs engine of the type built by Corpet Louvet for the shunting locomotives of the Nord*

on the discs is extremely small, and that after a relatively short mileage the disc faces become hardened and no further wear takes place. The magnets are actuated by 24-volt current controlled from a small hand switch in the cab, and the electrical equipment is so simple that there is little likelihood of any failure occurring. Some similar boxes of smaller capacity have been in service for about 18 months without the occurrence of any serious trouble.

Four speeds in each direction are provided in the Cotal box, but by means of an additional two-to-one mechanical gearbox these speeds can be doubled if desired, with the result that eight locomotive speeds are obtainable on normal engine revolutions. The main multi-plate friction clutch between the engine and gearbox is pneumatically operated, and the final drive to the axles is by Renolds chains which can be adjusted without removing them from the locomotive. For the guidance of the driver, both a speed indicator and a cab signalling device are fitted.



Two magnetic discs with sun and planet wheels of the 240 b.h.p. Cotal gearbox of the Nord shunters

## THE DUTCH DIESEL-ELECTRIC TRAINS

*Another statement by Mr. Hupkes, the Chief Mechanical Engineer*

ON May 15, several of the Maybach-engined diesel trains were replaced in service, and, with the five Stork-engined trains which have been working satisfactorily since their completion in November last, are making a daily mileage of 4,000 train-set km.

Last year, when the troubles began, Mr. Hupkes gave a brief account to the general public, but indicated that he would make no further comments until the troubles had been rectified. He has now given further details of the difficulties encountered, and as these are of considerable value they are given in abstract form below.

The engines worked at first without any appreciable trouble, but after about 20,000 km., defects such as pitting and wear showed themselves in the big-end roller bearings. After another 10,000 km. this damage was so great that breakages of shock absorbers and cylinder liners occurred. This meant that after 30,000 km. thorough overhaul was necessary, and even this distance was only possible with constant watch on the engines. Fully 100,000 km. should have been possible, so that much improvement was wanted. Explosions in the exhaust pipes occurred, but there was nothing near to catch fire from them.

It has been previously announced that the principal difficulties were due to the motors being overloaded when running at low revolutions (see *Diesel Railway Traction Supplement*, February 22, 1935), so that an alteration in this condition was expected to enable running to be resumed. The work was pushed forward on those lines with the aid of Maybach and Werkspoor. The damage to the roller bearings, though less, continued, and so other causes had to be looked for.

The overhauling was stopped and the two firms set to

work to do this. After a good deal of study it was found that the damage was due to lateral vibrations, as distinct from torsional, in the crankshaft at certain critical speeds. Such vibrations were little understood, measurements being non-existent as far as is known. No instruments were available, and much time was taken up in designing some. At first these had critical vibration periods of their own which vitiated their indications, so that further work was necessary. It was also necessary to measure the vibrations not only at the two ends of the crankshaft, but at selected points in between.

It was found that the trouble at the critical speeds within the usual working range of 800 to 1,400 r.p.m., could be eliminated by attaching counterweights opposite the crankwebs, but it was not at all easy to see how they could be fixed, especially as it was desirable for them to be removable, at least during trials. The first designs were not satisfactory, but two others have been found which give every promise of being so. To test them thoroughly, a number of trial runs have been made, and full load tests undertaken of 100-200 and 400 hr. duration. The engine makers have loyally recognised their liability, now that the causes are found, and are doing their best to get everything right. They are bearing the cost of overhauling and maintaining the engines for the present partial service.

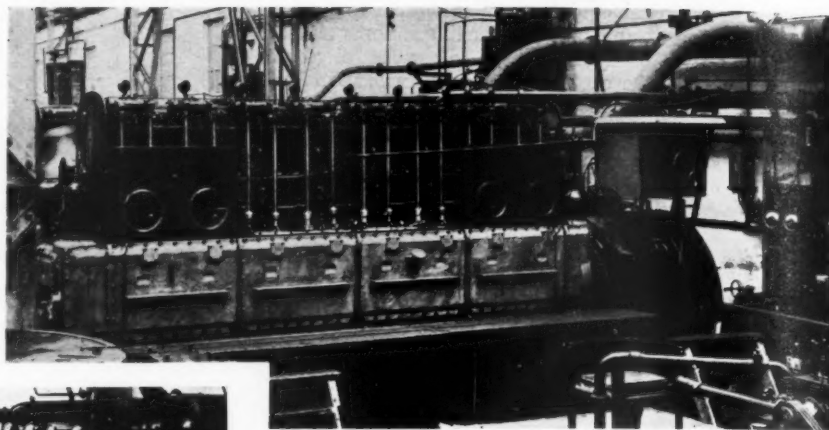
It may be asked whether such bearing faults had not occurred in similar engines before? They had, and were even seen during some trial runs of the Netherlands units prior to handing over. But they were ascribed to torsional vibrations and steps were taken to diminish the latter and keep them within certain limits. The 100-hr. full load test was then carried out satisfactorily.

Four of the 320 b.h.p. diesel-electric triple-car trains of the Netherlands Railways at Utrecht

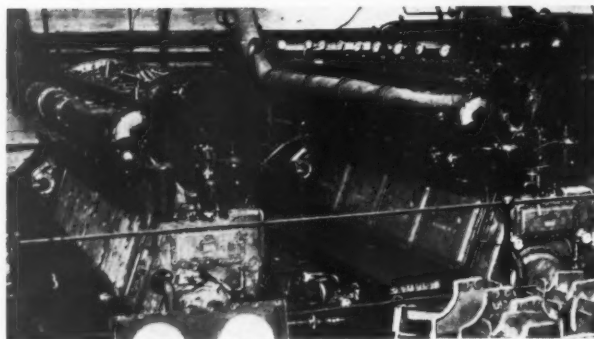


## BIG LOCOMOTIVE OIL ENGINES FOR INDIA

*Official trials, including a continuous run of 150 hours, have been conducted on two Armstrong-Whitworth units intended for service over the Sind desert*



*Two views of the Armstrong-Sulzer 1,200 b.h.p. engines on the test bed. Over a continuous run of 150 hr. the fuel consumption averaged 0.37 lb. per b.h.p. hr.*



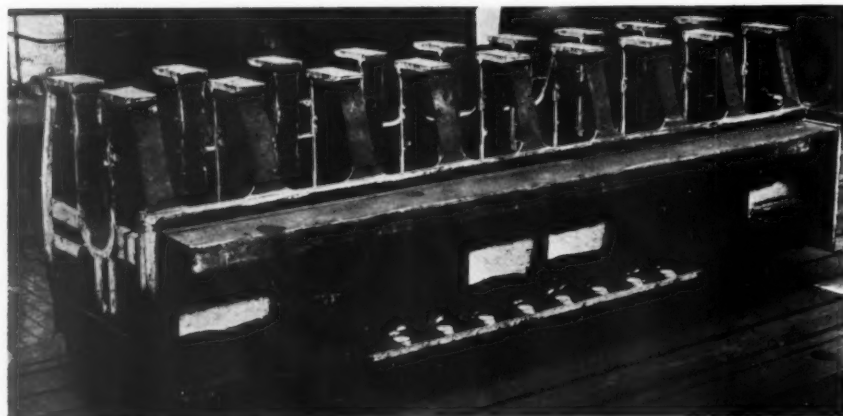
**G**REAT satisfaction was expressed some time ago at the order for two main-line oil-electric locomotives which was booked by Sir W. G. Armstrong-Whitworth & Co. (Engineers) Ltd. for operation on the Sind mail service of the North Western Railway of India. Although these locomotives are not yet completed, the engines are finished and have run their trials.

The engines are of the Armstrong-Sulzer four-stroke type with direct fuel injection through Bosch pumps and nozzles. The continuous output of 1,200 b.h.p. at 630 r.p.m. is developed in eight cylinders 340 mm. by 430 mm. (13.4 in. by 16.9 in.), with a brake m.e.p. of 79 lb. per sq. in. and a piston speed of 1,778 ft. per min. The weight of the empty engine is 14 tons, corresponding to 26 lb. per b.h.p., and that of the main engine-generator

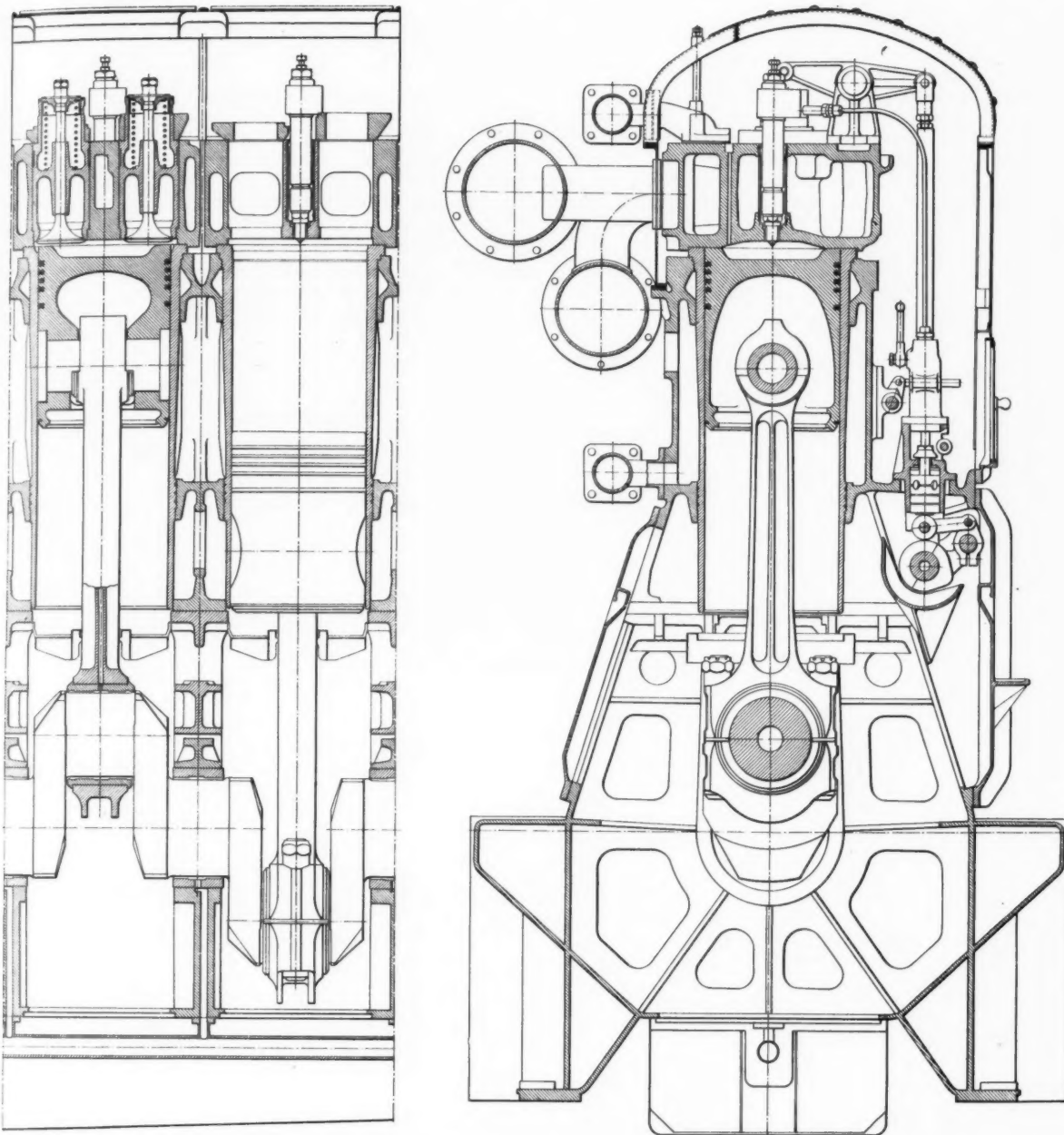
unit with contained water and oil, 22.3 tons. A feature of the design is the incorporation of a welded steel crankcase in which great lateral stiffness has been obtained by the double triangulation of the lower side members. The cast iron cylinder blocks are in two groups of four, bolted to each other and to the crankcase. A separate liner is provided in each cylinder and the cooling water in the jackets passes through a narrow neck near the cylinder head to ensure its projection into the upper parts of the jacket and head.

Forged and heat treated aluminium alloy pistons are used, and the crown is hollowed out to form a symmetrical combustion space suited to the multi-hole injection nozzle. The fully-floating gudgeon pins carry nickel-chrome steel connecting rods running on big-end bearings consisting of gunmetal shells with white metal lining. The single-piece crankshaft is of open-hearth oil-treated steel running in bearings having a white metal lining on a steel shell. The bearing between Nos. 7 and 8 cylinders takes up end thrust in addition to its normal load. Access to the main and big-end bearings is gained through large aluminium doors extending over the joint between the crankcase and cylinder block.

A set of gearing at the coupling end of the crankshaft



*General view of the welded steel crankcase of the Armstrong-Sulzer 1,200 b.h.p. diesel engine. Partly with the assistance of this form of construction, the engine weight has been brought down to 26 lb. per b.h.p.*



*Sectional arrangement of eight-cylinder Armstrong-Sulzer engine with a continuous output of 1,200 b.h.p. and a maximum rating of 1,260 b.h.p.*

drives the camshaft, which is carried on bearings mounted on the cylinder block; vertical push rods actuate the inlet valve and exhaust valve on each cylinder head. The camshaft drives the centrifugal governor, which is designed to give three definite engine speeds; the change from one speed to another is effected by varying the load on the governor spring by means of air-operated pistons brought into action through electro-pneumatic valves under the control of the driver. The timing of the fuel injection is varied slightly for each change of speed. Each cylinder has its own fuel pump, supplied with fuel through an Auto-Klean filter from an overhead gravity tank. The fuel is lifted from the main tanks by a gear-

driven transfer pump. The main tanks will be located along the sides of the locomotive.

The gearing at the coupling end of the engine drives also a centrifugal cooling water pump through a duplex chain, and at the other end are gear-driven pumps for the forced lubrication and for the oil circulation. The former takes the cooled and filtered oil and supplies it to the various bearings, from which it drains to the sump, there to be picked up by the second pump and passed through the cooler and filter. The engine is stopped automatically if the oil pressure drops. The Enot one-shot system is provided for the lubrication of the valve stems before starting, and for occasional lubrication in service.

## NOTES AND NEWS

**New Italian Diesels.**—An order has been placed for ten double-engined 250 b.h.p. diesel-electric railcars for service over the heavily-graded 950 mm. gauge Calabro-Lucane line in Italy, which has in service a smaller diesel railbus and a 440 b.h.p. diesel-electric mobile power house cum locomotive; the last-named has been in service since 1924.

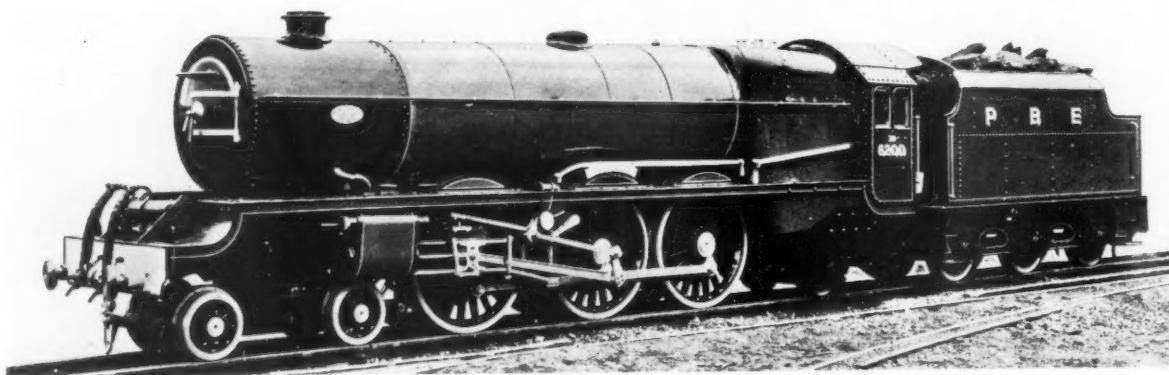
**H. & N. Hydraulic Transmission.**—In the article on the Haslam & Newton hydraulic transmission which was published in the May 17 issue of this Supplement, an error was made in the left-hand column of p. 1011. The sentence commencing in the eighth line after the crossheading "Railway Traction Units" should have

56 tons at  $3\frac{1}{2}$  m.p.h. on the level. The steam engine is named *Wasp*, and has two cylinders 5 in. by 6 in. driving  $16\frac{1}{4}$ -in. wheels spread over a base of 2 ft. 9 in. The boiler is of the single-flue marine type with a grate area of 1.75 sq. ft. and 54 tubes of  $1\frac{1}{8}$ -in. dia., giving a heating surface of 48 sq. ft. The locomotive weight is 3.55 tons.

**A Miniature Diesel.**—The railway on the pleasure beach at Blackpool has acquired recently a miniature diesel locomotive formed to an exterior model of the L.M.S.R. Pacific steam locomotive *Princess Royal*. The locomotive was built by Hudswell Clarke & Co. Ltd., and is powered by a 32 b.h.p. two-cylinder diesel engine normally running at 1,000 r.p.m., the torque of which is

Right: Diesel and steam shunting engines on the 18-in. gauge lines in Horwich works and yard, L.M.S.R.

Below: Miniature diesel locomotive running on the pleasure beach railway at Blackpool. Externally it is a model of the L.M.S.R. Pacific, "Princess Royal"



read: "The motor dimensions for a torque multiplication of six need only be  $\sqrt[3]{3}$ , or 1.44 times those of the pump where the latter is geared to run at half engine speed."

**A.E.C. Extension.**—A new shop, 100 ft. long and 60 ft. wide, is being laid down at the Southall works of the A.E.C. for the erection of railcar and bus chassis. It is to contain four roads, one of which will have a pit 60 ft. long, and should materially assist in the quicker production of the well-known A.E.C. diesel-mechanical railcar, as running on the G.W.R.

**L.M.S.R. Works Shunters.**—One of the accompanying photographs shows two methods of dealing with shunting traffic over the 18-in. gauge tracks in Horwich works and yard. The diesel unit, named *Crewe*, was built by Hudswell Clarke & Co. Ltd., and is powered by a two-cylinder 20 b.h.p. diesel engine running at 800 r.p.m., which drives the wheels through a gearbox, jackshaft and rods. The wheelbase is 3 ft., the weight about  $3\frac{3}{4}$  tons, and the tractive effort 1,500 lb.; the haulage capacity is

transmitted to the wheels through a two-speed gearbox fitted with a hydraulic coupling. The gearbox and final drive worm wheels were made by David Brown & Sons (Huddersfield) Ltd.

**Union Pacific Train Rebuilt and in Service.**—The Union Pacific six-car diesel-electric train which made the record run from Los Angeles to Chicago and New York has been partially rebuilt by the provision of another car; by the installation of a 16-cylinder 1,200 b.h.p. Winton diesel engine and the modification of the trucks and suspension to eliminate vibration and swaying at high speeds. The original engine was of 900 b.h.p. This train, which has been named *City of Portland*, now consists of seven vehicles, viz., a power car, mail and baggage car, dining-lounge car, three Pullman sleeping cars, and a coach-buffet car. It has been placed in service between Chicago and Portland (Oregon) on a 40-hr. schedule, and makes six round trips a month from the Chicago and North Western terminal in Chicago.